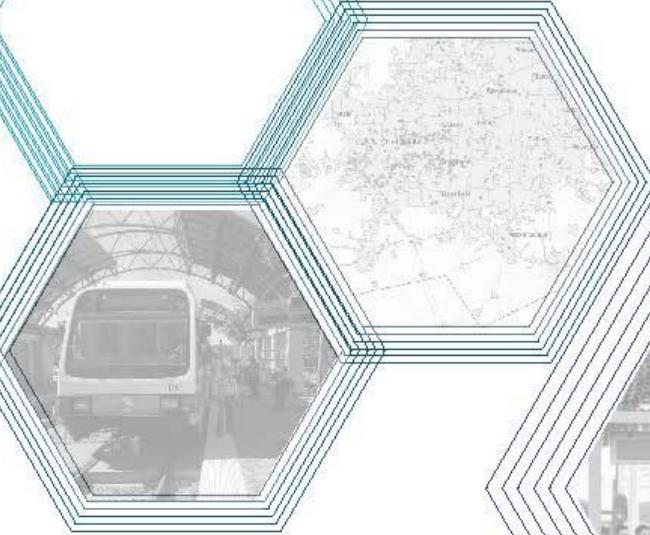




Transportation Equity Scorecard: A Tool for Project Screening and Prioritization

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FINAL REPORT

TRANSPORTATION EQUITY SCORECARD: A TOOL FOR PROJECT SCREENING AND PRIORITIZATION

Final Report and User Guide

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For:

Center for Transportation, Equity, Decisions, and Dollars (CTEDD)

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EXECUTIVE SUMMARY

Introduction and Objectives

Equity is a representation of fairness in the distribution of benefits and burdens. It is an important expectation of the public in transportation planning and project selection, as these activities can have significant equity impacts. Increasingly, metropolitan planning organizations (MPOs) and local governments are evaluating both plan and projects from an equity perspective. However, approaches used by MPOs and local governments to identify and prioritize projects of benefit to traditionally underserved populations vary in scope and effectiveness. This user guide and companion transportation equity scorecard tool are designed to serve as a framework to assist MPOs in their efforts to advance equity during project screening and prioritization.

Specific research objectives include the following:

1. Identify key criteria for use in evaluating and ranking projects based on their contributions to addressing the transportation needs of disadvantaged populations (e.g., safety, mobility, affordability, health, and access to opportunity);
2. Develop a spreadsheet-based project screening tool and scoring system using the compiled list of criteria and test and refine the tool in collaboration with the Hillsborough MPO, using actual data from the region to demonstrate its utility;
3. Prepare a user guide to assist MPOs in tool application, along with complementary methods and approaches (e.g., GIS, public involvement).

Methodology

The equity criteria included in the scorecard tool and user guide were formulated based on a comprehensive review of the literature and current practice, including findings from previous equity studies. Key among these studies was a national review of MPO practices for integrating equity into project prioritization (Williams et al., 2019). Thirty-five case examples across the nation were explored in that study, to identify and document project prioritization methods that advance equity.

A variety of factors important to equity in planning and project prioritization were identified through this review. These factors relate to access to opportunity, a healthy environment, and affordable mobility options, to name a few. The equity factors and criteria were then compiled and organized into categories for use in scorecard development. Methods for understanding the various criteria were then examined and documented, including simple and advanced methods using geographic information systems (GIS), travel demand modeling, professional knowledge, and public involvement strategies.

Finally, the criteria were integrated into an excel spreadsheet and automated using Visual Basic. Beta testing was conducted on projects in the City of Tampa including the 34th Street Safety

Improvements and the East-West Green Spine Phases 2 & 3. The project team collaborated with the Hillsborough MPO in the Tampa metropolitan area to develop and beta test the tool using actual demographic, destination, and project data from the region. This process was an opportunity to assist the MPO in advancing equity as it explores projects to address the goals of a recently approved funding referendum for bicycle, pedestrian, transit and roadway projects. During the beta testing, refinements were made to improve the tool based on input from MPO staff and representatives of the Transportation Disadvantaged Service Board and Livable Roadways Committee.

What is the Transportation Equity Scorecard?

The Transportation Equity Scorecard is a tool designed to assist MPOs and other transportation planning agencies in prioritizing projects that advance equity. Although developed for use by MPOs and local planning agencies to promote equity, elements of the tool and processes could be used by many other types of agencies.

Two Excel-based versions of the scorecard are available for project evaluation. An automated version of the tool automatically generates scores based on selected responses. The second, non-automated, version requires users to manually input scores.

When to Use the Tool?

The tool could be used within a broader project evaluation scoring system or as a separate or additional assessment specific to equity. The guide and tool could also aid MPOs and local governments in formulating projects with important equity impacts and user benefits. Example uses for the tool include, but are not limited to:

- Moving projects from a needs list to a cost affordable list in the context of metropolitan transportation planning;
- Selecting projects for programming in the transportation improvement program (TIP);
- Selecting projects as part of a specific agency plan, program, or initiative (e.g., Transportation Disadvantaged (TD) plan, bicycle/pedestrian plan, Transportation Alternatives Program (TAP), safety, complete streets, etc.);
- Selecting projects that best advance an equity plan or policy;
- Selecting project alternatives that advance equity.

How to Use the Tool?

The equity evaluation for the tool involves the four key steps shown in Figure ES 1. Each step requires careful consideration of community needs and regional goals. Stakeholder and public outreach is also necessary for an effective evaluation.

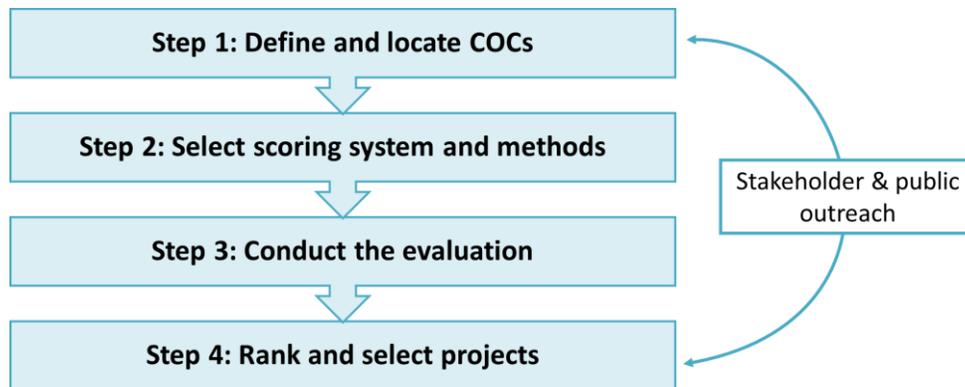


Figure ES 1. Equity project screening and prioritization process

Step 1: Define and Locate COCs

The first step in the prioritization process is to locate communities of concern (COCs) using GIS. The process is generally as follows:

- Identify the relative concentration of COCs at the census tract, block group, or traffic analysis zone (TAZ) level for a set of selected socio-economic variables;
- Identify the regional average for that variable (or the average based on agency or jurisdictional boundaries);
- Identify and visually represent areas with larger concentrations (e.g., greater than one or two standard deviations above the average) of one or more groups of COCs.

A threshold-based method is commonly used to identify areas with a higher concentration of COCs. Concentrations of COCs are defined as follows (Williams and Golub, 2018):

- A low to moderate concentration of COCs is any block group with one or two variables that exceed the countywide average by at least one standard deviation.
- A high concentration of COCs is any block group with two or more variables that exceed the countywide average by at least one standard deviation.

The resulting maps are then used to analyze potential project impacts on each specific population. The results may also be combined into a composite map that identifies concentrations of COCs in the region for more general analyses.

Step 2: Select Scoring System and Methods

The equity scorecard tool scores each project against the factors/criteria based on the concentration of COCs impacted. A score of one (+1) is attributed to a project that serves low to moderate concentrations of COCs. Two (+2) is attributed to a project that serves high concentrations of COCs. A score of negative ten (-10) is attributed to a project that is expected to adversely impact COCs. The relative concentration of COCs will vary by region; therefore, each MPO or local government will need to set their own thresholds.

Each category in the scorecard can receive up to 6 points for a maximum possible equity score of 30. A weighting system allows agencies to assign a weight to each score based on the magnitude of the anticipated impact on equity. The scorecard multiplies a given criterion by 2 if it is expected to have high equity impacts in relation to that criterion. Under the weighted scoring system, each category can receive up to 12 points for a maximum possible equity score of 60. See Table ES 1 for the scoring system and weights. The relative impact on equity is determined using regional or national guidelines, as well as thresholds selected by the agency.

Table ES 1. Scoring System

	Score		Weight		
	Points (COCs)	Max Points	Points (Impact)	COCs*Impact	Max Points
Criterion	-10, 0, +1, or +2	2	2	(-10, 0, +1, or +2)*(2)	4

Step 3: Conduct the Evaluation

The third step of the process is the evaluation (see Figure ES 2). This step begins with collecting and assembling the data. After data are collected and assembled, the project type, project location or coverage, and location of COCs in relation to the project are identified. A set of criteria are provided as questions to facilitate the evaluation.

Transportation Equity Scorecard Tool

Directions : Select " No, Yes, or Yes, high impact". See user guide for details.

Project ID |

	Criteria	Response
COCs	What is the concentration of COCs within a 1/4 mile of the project?	
Access to Opportunity	Does the project improve access to jobs?	
	Does the project improve access to educational facilities?	
	Does the project improve access to community services?	
Health and Environment	Does the project improve access to health care?	
	Does the project improve access to grocery stores or markets with healthy and fresh affordable food?	
	Does the project increase livability through design and/or mitigation measures?	
Safety and Emergency Evacuation	Does the project implement appropriate safety countermeasures for pedestrians and bicyclists at high-crash locations?	
	Does the project implement appropriate safety countermeasures at other (non-high crash) locations?	
	Does the project improve emergency evacuation?	
Affordability	Does the project decrease the share of household income consumed by transportation and housing?	
	Does the project reduce travel time or eliminate a barrier to/from affordable housing?	
	Does the project provide affordable transportation choices, especially in areas with a high transportation cost?	
Mobility	Does the project improve or expand bicycle or pedestrian facilities?	
	Does the project improve transit service or access, including first mile/last-mile access?	
	Does the project include special measures to improve accessibility for persons with disabilities?	
Burdens	Does the project cause cumulative, disproportionate, or other major adverse impacts?	

Cancel Save & Continue

Figure ES 2. Evaluation page

Step 4: Rank and Select Projects

After evaluating projects and assigning scores to individual criteria, the scores are summed to generate scores for each category and the total equity score (see Figure ES 3). The total scores are used to rank and identify projects that promote equity or specific dimensions of equity.

		Project ID
Category	Factor	
Access to Opportunity	Employment	
	Education	
	Community Services and Shopping	
Health and Environment	Health Care	
	Healthy Food	
Mobility	Transit Access and Service	
	Americans with Disabilities Act (ADA)	
Burdens	Adverse Impacts	
	Total Score	
		Project ID
	Access to Opportunity	
	Health and Environment	
	Safety and Emergency Evacuation	
	Affordability	
	Mobility	
	Burdens	
	Total	

Figure ES 3. Results

How is the User Guide Organized?

To assist agencies in the use of the tool, this final report and user guide provides contextual information on the equity categories and describes each step in the evaluation process. The document is organized into the following chapters:

- **Chapter 1** provides background information on the project and tool. It describes the purpose of the project, including the research objectives, methodology, tool applications, and key terms used throughout the document.
- **Chapter 2** describes each step in the project evaluation process. Screenshots of the Excel-based scorecard and accompanying figures and tables are used to illustrate the evaluation process.
- **Chapter 3 through 8** provides detailed information and demonstrates the evaluation for each equity category. Sections include:
 - Criteria - lists the equity factors and criteria for each category.
 - Data sources and variables - includes suggested data sources and tools.

- Methodology - is a three-part section. The first section generally describes suggested methods and provides an “Evaluation in Practice” to demonstrate how agencies currently evaluate project against the specified equity category. The second section provides basic methods for project evaluation, including prompts to evaluate the project against the criteria and weighted criteria. An example evaluation of the 34th Street project, in the City of Tampa, is included for each equity category. The complete evaluation of 34th Street and an additional example evaluation of the East-West Green Spine Phases 2 & 3 are provided in Appendix B. The third section provides optional methods for more rigorous analysis.
- **Chapter 9** describes complementary procedures to evaluate projects using the equity scorecard tool. These procedures include GIS analysis, public involvement, and distributional equity approaches.
- **Chapter 10** identifies additional considerations for tool users.
- **Chapter 11** provides a list of supplementary resources that can be referenced during the evaluation process.

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1. Introduction

Metropolitan planning organizations (MPOs) and local governments use a variety of methods to ensure that local and regional transportation plans and projects meet community needs. Increasingly, transportation planning agencies are also evaluating proposed projects from an equity perspective. Equity is a representation of fairness in the distribution of benefits and burdens. The Federal Highway Administration (FHWA) describes equity in transportation as follows (FHWA, 2019):

Equity in transportation seeks fairness in mobility and accessibility to meet the needs of all community members. A central goal of transportation equity is to facilitate social and economic opportunities by providing equitable levels of access to affordable and reliable transportation options based on the needs of the populations being served, particularly populations that are traditionally underserved... An equitable transportation plan considers the circumstances impacting a community's mobility and connectivity needs and this information is used to determine the measures needed to develop an equitable transportation network.

Equity is an important expectation of the public in transportation planning and project selection, as these activities can have significant equity impacts. However, methods used to identify and prioritize transportation projects of benefit to traditionally underserved populations vary in scope and effectiveness. This user guide and companion equity scorecard tool provide a framework for use by MPOs and other agencies to advance equity during project screening and prioritization. Unlike traditional methods, which may only consider proximity to the population or avoiding or mitigating adverse project impacts, the criteria and methods incorporated in the tool aim to advance transportation projects for funding based on the extent to which they directly advance the needs of underserved populations.

1.1 Research Objectives

The purpose of the study was to develop a scorecard tool and user guide building on the national state of the practice relative to equity in project prioritization. The study was guided by the following research objectives:

1. Identify key criteria for use in evaluating and ranking projects based on their contributions to addressing the transportation needs of disadvantaged populations (e.g., safety, mobility, affordability, health, and access to opportunity);
2. Develop a spreadsheet-based project screening tool and scoring system using the compiled list of criteria and test and refine the tool in collaboration with the Hillsborough MPO, using actual data from the region to demonstrate its utility;
3. Prepare a user guide to assist MPOs in tool application, along with complementary methods and approaches (e.g., GIS, public involvement).

1.2 Methodology

The equity criteria in the scorecard tool were formulated based on a comprehensive review of the literature and current planning practice, including findings from previous equity studies. Key among these studies was a national review of MPO practices for integrating equity into project prioritization (Williams et al., 2019). Thirty-five case examples across the nation were explored in that study, to identify and document criteria and project prioritization methods that advance equity.

A variety of factors important to equity in planning and project prioritization were identified through this review. These factors relate to access to opportunity, a healthy environment, and affordable mobility options, to name a few. The equity factors and criteria were then compiled and organized into categories for use in scorecard development. Methods for evaluating projects in relation to the various criteria were examined and documented, including simple and advanced methods using geographic information systems (GIS), travel demand modeling, professional knowledge, and public involvement strategies.

Finally, the criteria were integrated into an excel spreadsheet tool and automated using Visual Basic. The project team collaborated with the Hillsborough MPO in the Tampa metropolitan area to develop and beta test the tool using actual demographic, destination, and project data from the region. Beta testing was conducted on projects in the City of Tampa, including the 34th Street Safety Improvements and the East-West Green Spine Phases 2 & 3. This process was an opportunity to assist the MPO in advancing equity as it explores projects to address the goals of a recently approved funding referendum for bicycle, pedestrian, transit and roadway projects. During the beta testing, refinements were made to improve the tool based on input from MPO staff and representatives of the Transportation Disadvantaged Coordinating Board, MPO Livable Roadways Committee, MPO Technical Advisory Committee, and the Citizens Advisory Committee.

1.4 Tool Applications

This tool could be used within a broader project evaluation scoring system or as a separate or additional assessment specific to equity. The guide and tool could also aid MPOs and local governments in formulating projects with important equity impacts and user benefits. Although developed for use by MPOs and local planning agencies to promote equity, elements of the tool and process could be used by many other types of agencies. Example uses for the tool include, but are not limited to:

- Moving projects from a needs list to a cost affordable list in the context of metropolitan transportation planning;
- Selecting projects for programming in the transportation improvement program (TIP);
- Selecting projects as part of a specific agency plan, program, or initiative (e.g., Transportation Disadvantaged (TD) plan, bike/ped plan, Transportation Alternatives Program (TAP), safety, complete streets, etc.);

- Selecting projects that best advance an equity plan or policy;
- Screening individual projects or project alternatives for equity implications.

The tool and supporting methods are primarily designed to meet the needs and capabilities of MPOs and local governments, but could also help support those of other organizations. Both basic and advanced methods are provided for this purpose. The tool could also be used to identify projects that score high in specific categories that advance regional goals and community needs. For example, projects may receive a low overall equity score but receive a high score for a specific category, such as access to opportunity. Those projects, regardless of the overall equity score, could then be prioritized if located in areas with high access to opportunity needs.

1.3 Key Terms

Some key terms used in this report are defined here.

Communities of concern (COCs): one or a combination of traditionally underserved or transportation disadvantaged population groups, including but not limited to low-income, minority, elderly, young, disabled, zero-vehicle, Limited English Proficiency (LEP), single-parents, and rent-burdened households.

Community services: public locations, such as community centers, parks and recreational areas, and recreation centers, that provide space for meetings, activities, events, public services, and other uses by community members.

Essential destinations: areas that people are likely to travel to in order to fulfill their daily needs or desires. Includes essential services and destinations, such as employment, shopping, entertainment, recreation, health care, and other services.

Equity areas: locations with a high proportion of transportation disadvantaged populations or communities of concern (COCs), and/or areas having special needs that could be partly addressed through transportation investments, such as areas with high instances of asthma, obesity, diabetes, or other health concerns, as well as food deserts.

Food deserts: an area that has limited access to affordable and nutritious food, particularly fresh produce and other unprocessed foods.

2. Using the Tool

The equity evaluation for the tool involves the four key steps shown in Figure 1. Each step requires careful consideration of community needs and regional goals. Stakeholder and public outreach is also necessary for an effective evaluation. Continuous stakeholder outreach and public involvement are used to fill knowledge gaps as agency staff collects data and to validate project evaluation results (see Section 9.1 for more information on suggested public involvement techniques).

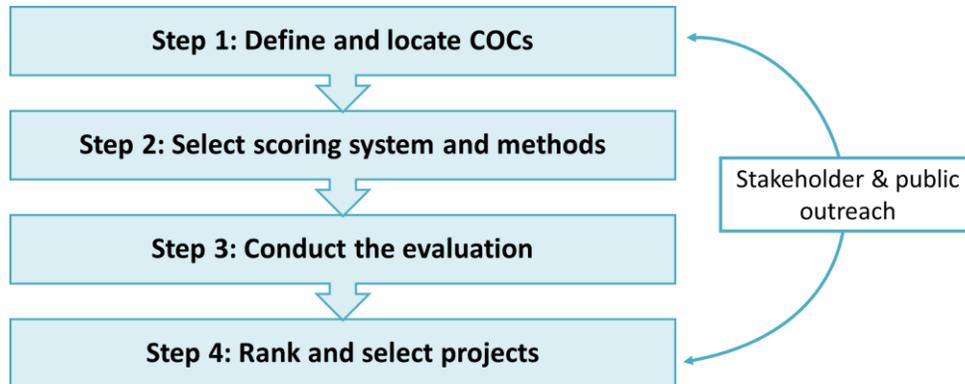


Figure 1. Equity project screening and prioritization process

Review the Scorecard

Regions may have equity-related goals, policies, plans, or emphasis areas to consider during the evaluation. Additionally, communities have multiple needs, with some issues having greater priority than others. For example, access to opportunity may be a key priority of some communities, whereas health or safety may be more important for others. Agencies can advance regional goals and community priorities by assigning greater weight to these issues in the tool prior to project screening.

The equity scorecard includes six categories for use in project screening and prioritization. These categories and the relevant factors are as follows:

- **Access to Opportunity:** employment, education, and community services (including parks and recreational facilities).
- **Health and Environment:** health care, healthy food, and the environment.
- **Safety and Emergency Evacuation:** safety and emergency evacuation.
- **Affordability:** housing, transportation, and housing and transportation costs.
- **Mobility:** active transportation, transit access and service, and Americans with Disabilities Act (ADA) considerations.
- **Burdens:** the adverse impacts of projects.

Each factor has criteria that address a specific transportation-related equity area. Proposed projects that advance the criteria within the first five categories are those with the greatest potential to address the needs of COCs. Keep in mind that the categories in the tool often overlap. For example, access to opportunity is directly related to improved mobility. Potential adverse impacts on COCs are reflected in the sixth category, burdens.

Agencies may choose to adapt the tool to best reflect regional goals, objectives, and policies. This step may involve modifying the categories, factors, or criteria. See Appendix C for instructions to modify the tool. The process and reasons for choosing the categories, factors, and criteria should be well documented and effectively communicated to stakeholders and the public.

Two Excel-based versions of the scorecard are available. Each version of the tool is customizable, allowing users to easily add, remove, or modify the equity categories, factors, criteria, and scoring system. An automated version automatically generates scores based on selected responses. Instructions to modify the automated Excel-based tool using Visual Basic are provided in Appendix C. The second, non-automated, version of the tool is provided as an Excel file and requires users to manually input scores. This version can be modified using standard functions in Excel.

Step 1: Define and Locate Communities of Concern (COCs)

The first step in the prioritization process is to locate COCs using GIS. The methods suggested here are intended to guide MPOs and local agencies without an established process for identifying COCs. Agencies with an established process may use existing methods or adapt them using the method provided in this guide.

The American Community Survey (ACS) is a key data source to identify COCs and generate relative concentrations of each population group. Table A 1, in Appendix A, illustrates some of the ACS variables that can be used to define COCs, which include, but are not limited to:

- Low-income households
- Zero-vehicle households
- Racial or ethnic minorities
- Elderly
- Youth
- Limited English Proficiency (LEP)
- Disability
- Female head of household
- Single-parent households
- Households receiving food stamps
- Households in neighborhoods with low to medium home values
- Households where the head has no high school education
- Rent-burdened households or renters paying more than 50 percent of their household income on housing

A threshold-based method is commonly used to identify areas with a higher concentration of COCs. This can be accomplished in a variety of ways, as documented in previous research (Williams et al., 2019). The process is generally as follows:

- Identify the relative concentration of COCs at the census tract, block group, or traffic analysis zone (TAZ) level for a set of selected socio-economic variables;
- Identify the regional average for that variable (or the average based on agency or jurisdictional boundaries);
- Identify and visually represent areas with larger concentrations (e.g., greater than one or two standard deviations above the average) of one or more groups of COCs.

The suggested method to calculate the concentration of COCs is adapted from a methodology currently applied by the Hillsborough MPO. Concentrations of COCs are defined as follows (Williams and Golub, 2018):

- A low to moderate concentration of COCs is any block group with one or two variables that exceed the countywide average by at least one standard deviation.
- A high concentration of COCs is any block group with three or more variables that exceed the countywide average by at least one standard deviation.

The resulting maps are then used to analyze potential project impacts on each specific population. The results may also be combined into a composite map that identifies concentrations of COCs in the region for more general analyses.

NOTE: This evaluation does not apply to projects in areas with no COCs.

NOTE: Use the higher concentration when evaluating projects in areas with more than one concentration of COCs.

Step 2: Select Scoring System and Methods

The equity scorecard tool scores each project against the criteria based on the concentration of COCs impacted. A score of one (+1) is attributed to a project that serves low to moderate concentrations of COCs. Two (+2) is attributed to a project that serves high concentrations of COCs. A score of negative ten (-10) is attributed to a project that is expected to adversely impact COCs. The relative concentration of COCs will vary by region; therefore, each MPO or local government will need to set their own thresholds, as discussed in Step 1.

Table 1 shows the scoring system for the scorecard. Each category in the scorecard can receive up to 6 points for a maximum possible equity score of 30. A weighting system assigns a weight to each score based on the magnitude of the anticipated impact on equity. For example, a shared-use path or protected bicycle lane might be assigned a higher score than a new sidewalk. The scorecard multiplies a given criterion by 2 if it is expected to have high equity impacts in relation to that criterion. Under the weighted scoring system, each category can receive up to 12 points for a maximum possible equity score of 60, as shown in Table 1. The relative impact on equity is determined using regional or national guidelines, as well as thresholds selected by the agency.

Table 1. Scoring System

	Score		Weight		
	Points (COCs)	Max Points	Points (Impact)	COCs*Impact	Max Points
Criterion	-10, 0, +1, or +2	2	2	(-10, 0, +1, or +2)*(2)	4

Basic methods entail simple analysis based on project type and relative proximity to COCs. These methods generally include GIS, professional knowledge or public input, and field studies or observational studies to evaluate existing conditions. Advanced methods often include more advanced GIS analysis techniques and/or modeling.

Step 3: Conduct the Evaluation

The evaluation begins with collecting and assembling data. Data relevant to each criterion, including socio-demographic and socio-economic, health and environment, safety and emergency evacuation, affordability, and mobility data, are needed to assess projects. Typical data sources include U.S. Census data, project studies, and various types of GIS data, such as layers with the location of COCs. Tools or indices developed by other agencies or organizations for local or regional use may also be available to assist in the determination. See Chapters 3 through 8 for suggested data sources and variables for each criterion.

After data is collected and assembled, identify the following:

1. Project type (see Figure 2):
 - Complete Streets
 - Transit
 - Active Transportation
 - Other (e.g., safety or operational improvement, ADA retrofit, etc.) Please specify.

34th Street, City of Tampa
Results: The 34th Street project is a safety project.

Summary
 34th Street from Columbus Drive to Hillsborough Avenue is primarily a 2-lane undivided collector roadway with a posted speed of 30 mph, as shown in Figure 2. 34th Street provides a secondary north/south access between the port area and northeast Tampa with 40th Street being the primary north/south arterial. 34th Street has an average daily traffic volume of 6,000 to 8000.

In a review of city-wide fatal and incapacitating injury crashes from 2009 to 2011, this section of 34th Street was identified as having a clustering (14) of fatal and severe injury crashes. **As such, this section of roadway was analyzed for countermeasures to improve safety and apply as a candidate for Highway Safety Improvement Program (HSIP) Off-System Funds.** Appendix A: Photo Log contains all the field review photographs taken.

Figure 2. Identify the project type

- Project location or coverage (see Figure 3):

34th Street, City of Tampa
Results: The project is located on 34th Street between Columbus Drive and Hillsborough Avenue.

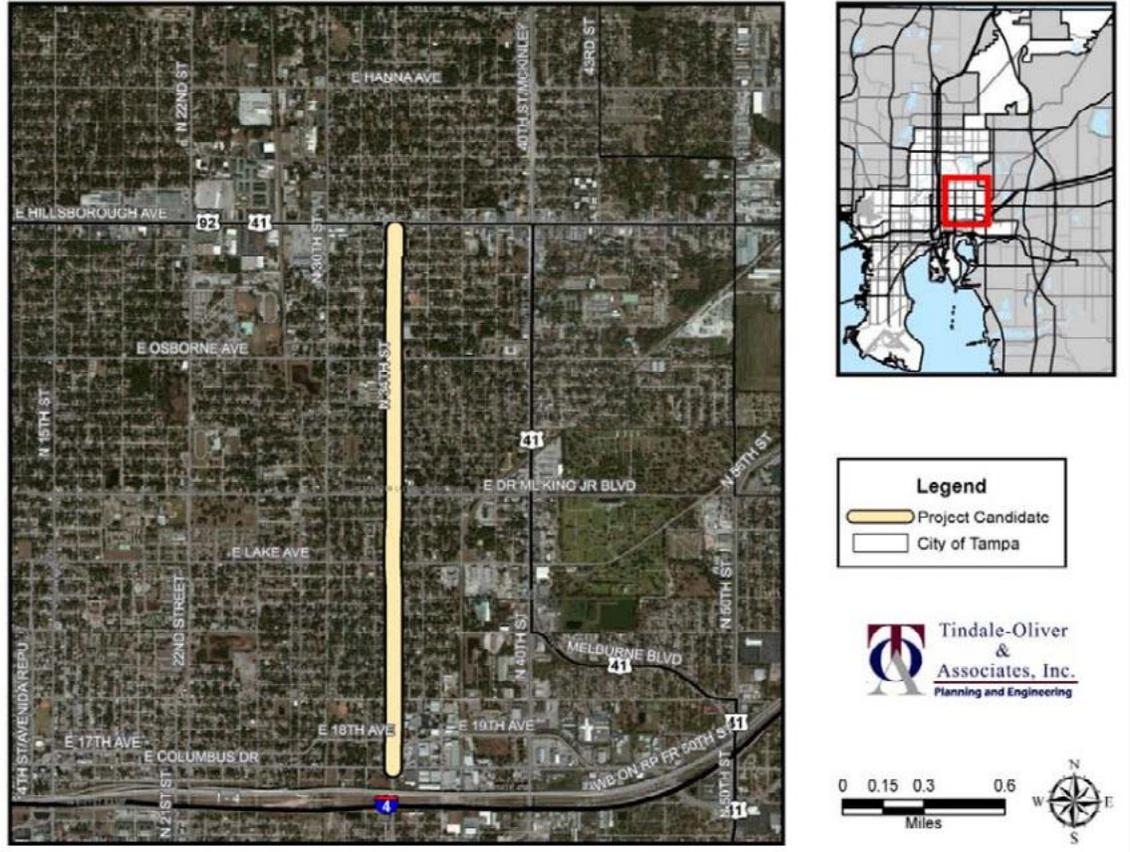


Figure 3. Identify the project location or coverage

- Location of COCs in relation to the project (GIS map using the threshold-based method) and concentration of COCs within a ¼ mile of the project (see Figure 4). Refer to Step 2 for more information relative to the concentration of COCs and the scoring system.

34th Street, City of Tampa
Results: The project is in an area with a high concentration of COCs.

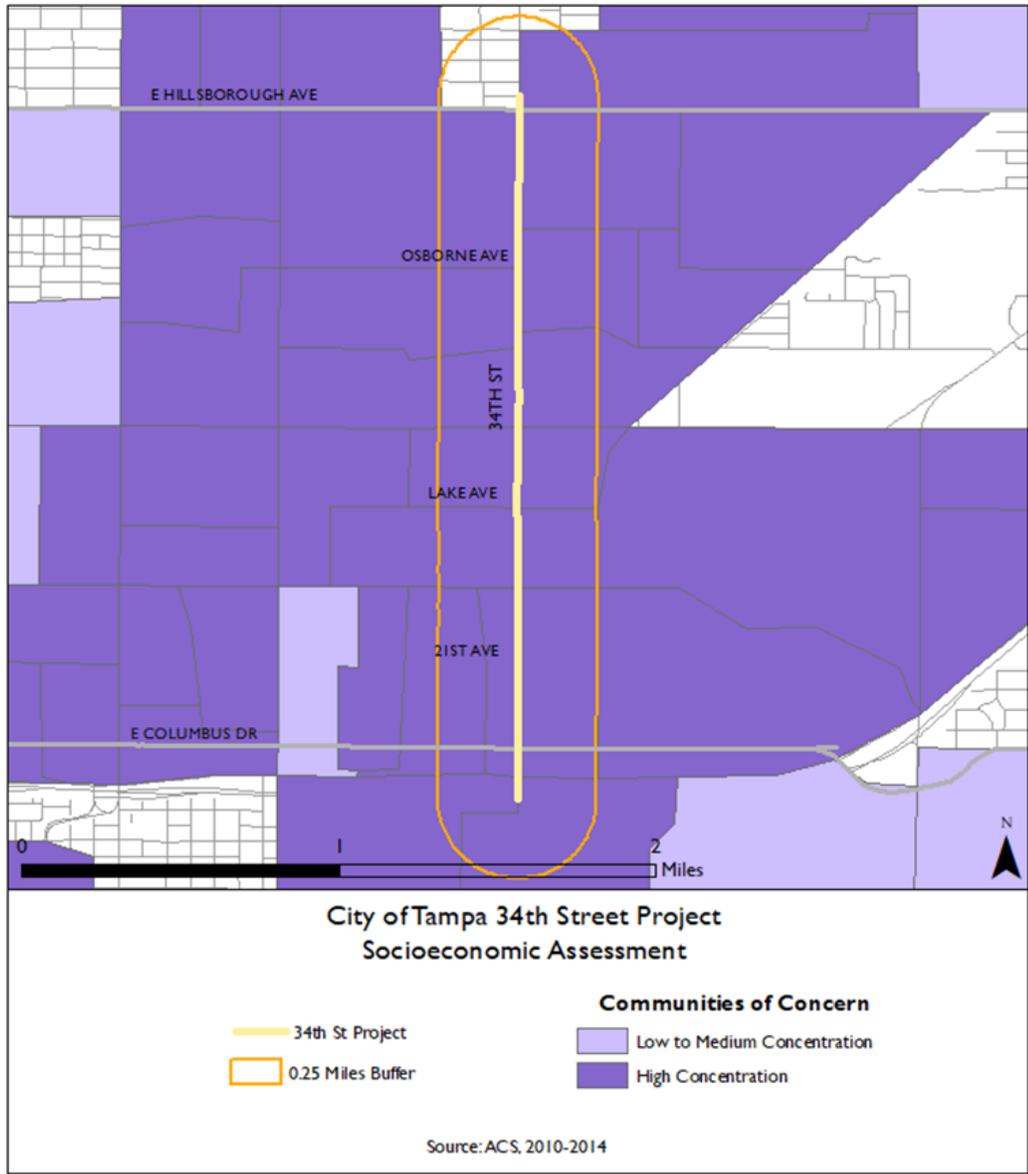


Figure 4. Identify the location and concentration of COCs

Commentary

- A ¼-mile is a nationally accepted guideline for a reasonable walking distance (Yang & Diez-Roux, 2013).

Use the criteria to evaluate the equity impacts of the project. Add the project and results to the scorecard.

Use the following steps to add projects to the automated scorecard:

1. Open the scorecard. If prompted, click “Enable Editing” and “Enable Content”.
2. Click the “Evaluation” tab and select “Add” (see Figure 5), a pop-up window will appear (see Figure 6).

Transportation Equity Scorecard Tool		
Directions: Click "Add" to answer questions for each project. See tabs named "Criteria Overview" and "Weights" for details related to the criteria and examples of "high impact" respectively.		
		Add
		Edit / Delete Project Rankings
Project ID		
Category	Factor	
Access to Opportunity	Employment	
	Education	
	Community Services and Shopping	
Health and Environment	Health Care	
	Healthy Food	

Navigation: Introduction | **Evaluation** | Project Rankings | Criteria Overview | Weights

Figure 5. Evaluation page

Transportation Equity Scorecard Tool

Directions : Select " No, Yes, or Yes, high impact". See user guide for details.

Project ID: |

Criteria	Response
COCs	What is the concentration of COCs within a 1/4 mile of the project?
Access to Opportunity	Does the project improve access to jobs?
	Does the project improve access to educational facilities
	Does the project improve access to community services?
Health and Environment	Does the project improve access to health care?
	Does the project improve access to grocery stores or markets with healthy and fresh affordable food?
	Does the project increase livability through design and/or mitigation measures?
Safety and Emergency Evacuation	Does the project implement appropriate safety countermeasures for pedestrians and bicyclists at high-crash locations?
	Does the project implement appropriate safety countermeasures at other (non-high crash) locations?
	Does the project improve emergency evacuation?
Affordability	Does the project decrease the share of household income consumed by transportation and housing?
	Does the project reduce travel time or eliminate a barrier to/from affordable housing?
	Does the project provide affordable transportation choices, especially in areas with a high transportation cost?
Mobility	Does the project improve or expand bicycle or pedestrian facilities?
	Does the project improve transit service or access, including first mile/last-mile access?
	Does the project include special measures to improve accessibility for persons with disabilities?
Burdens	Does the project cause cumulative, disproportionate, or other major adverse impacts?

Buttons: Cancel Save & Continue

Figure 6. Add project evaluation

3. Input the project ID.

- Using the evaluation results, select a response from the dropdown menu for each criterion. The suggested evaluation methods and example evaluations for each criterion are provided in Chapters 3 through 8 and in Appendix B. *Example evaluations do not rely on the weighted scoring system, and therefore, have a maximum possible score of 30.*

Response options for COCs include “None”, “Low to Moderate”, or “High” (see Figure 7).

		Project ID
	Criteria	Response
COCs	What is the concentration of COCs within a 1/4 mile of the project?	[Dropdown]
Access to Opportunity	Does the project improve access to jobs?	None
	Does the project improve access to educational facilities?	Low to Moderate
	Does the project improve access to community services?	High

Figure 7. Identify the concentration of COCs

Response options for equity categories include “No”, “Yes”, and “Yes, high impact”. All no responses receive a score of 0 (see step 2 for more details about the scoring system).

COCs	What is the concentration of COCs within a 1/4 mile of the project?	[Dropdown]
Access to Opportunity	Does the project improve access to jobs?	[Dropdown]
	Does the project improve access to educational facilities?	No
	Does the project improve access to community services?	Yes
Health and	Does the project improve access to health care?	Yes, high impact
	Does the project include special measures to improve accessibility for persons with disabilities?	[Dropdown]
Burdens	Does the project cause cumulative, disproportionate, or other major adverse impacts?	[Dropdown]

Cancel

Figure 8. Identify project impact on COCs

- Click “Save & Continue”, a pop-up window will appear confirming that the project has been added to the database.
- Click “OK”, the pop-up window will close. Scores will be generated in corresponding cells and a total score will be calculated at the bottom of the scorecard.

Repeat steps 2 through 6 to add more projects.

Use the following steps to edit or delete projects:

- Click the “Edit/Delete” button, a pop-up window will appear (see Figure 9).

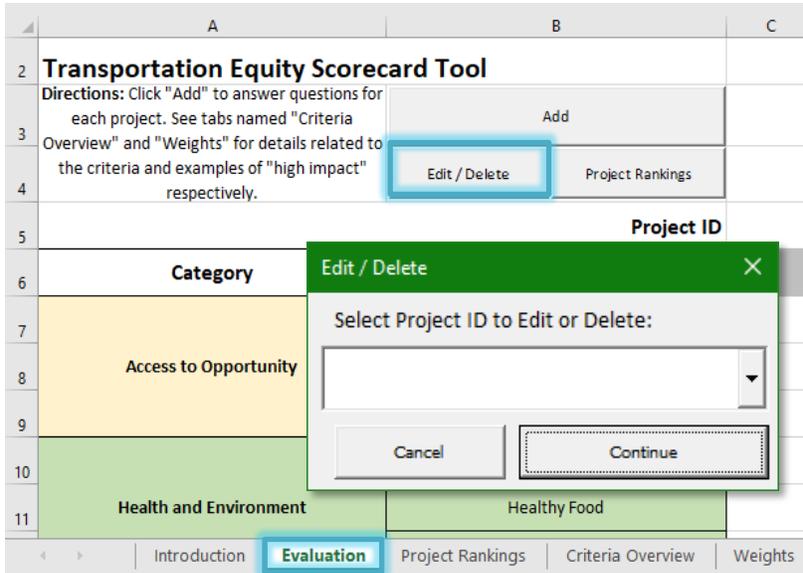


Figure 9. Edit/delete project evaluation

2. Select the project ID from the dropdown menu, the evaluation page for the selected project will appear (see Figure 10).

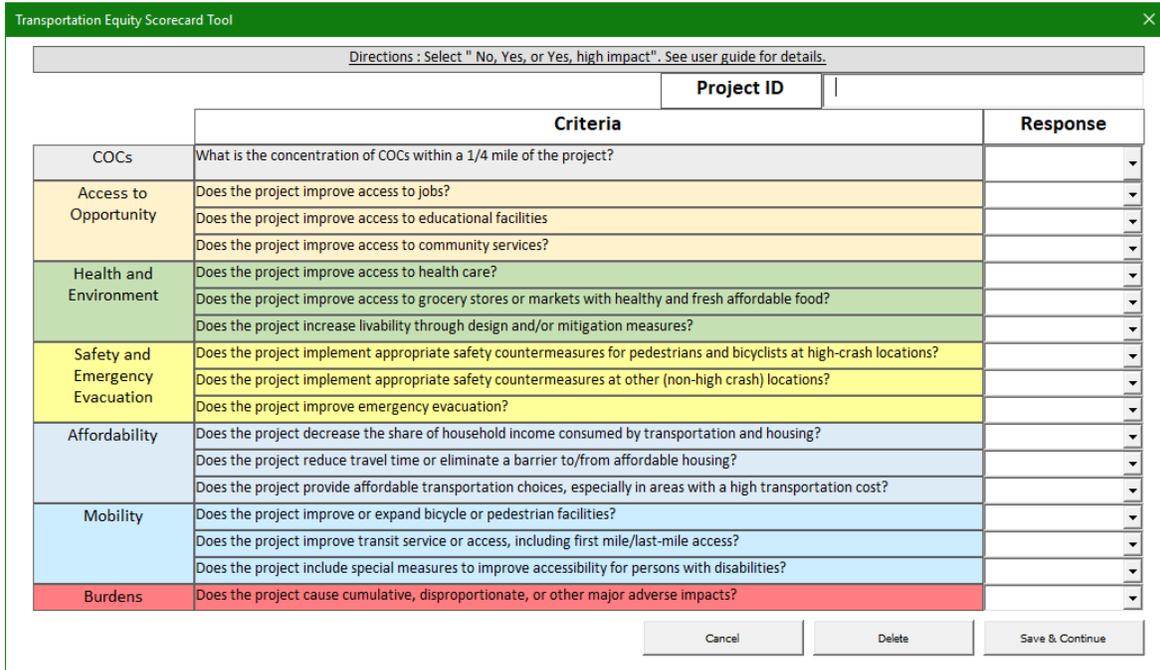


Figure 10. Edit or delete project information

- 3a. To edit a project:
Use the dropdown menu to change responses.

Click “Save & Continue”, a pop-up window will appear confirming that the project has been edited in the database. Click “OK”, the pop-up window will close.

Scores will be regenerated in the corresponding cells, and a total score will be recalculated at the bottom of the scorecard.

3b. To delete a project:

Click “Delete”, the project and corresponding scores will be removed from the scorecard.

Step 4: Rank and Select Projects

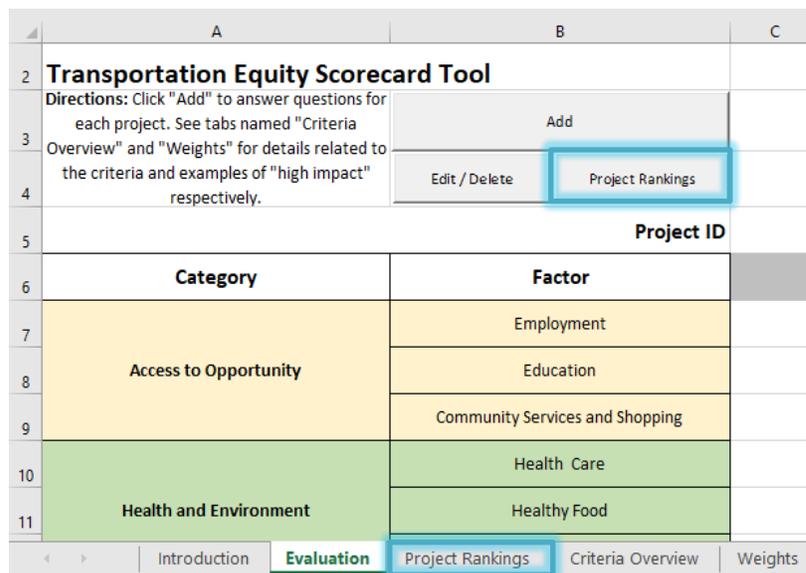
After the evaluation, criteria/factor scores are summed to generate category scores and the total equity score (Figure 11). The total scores are used to rank and identify projects that promote equity or specific dimensions of equity.

		Project ID
Category	Factor	
Access to Opportunity	Employment	
	Education	
	Community Services and Shopping	
Health and Environment	Health Care	
	Healthy Food	
Mobility	Transit Access and Service	
	Americans with Disabilities Act (ADA)	
Burdens	Adverse Impacts	
	Total Score	
		Project ID
		Access to Opportunity
		Health and Environment
		Safety and Emergency Evacuation
		Affordability
		Mobility
		Burdens
		Total

Figure 11. Results

Ranking projects based on the total score for each discrete category enables projects to be prioritized if they address identified needs in the project area. For example, projects may receive a low overall equity score, but receive a high score for a specific category, such as access to opportunity. Those projects, regardless of the overall equity score, could be prioritized for funding if located in areas with high access to opportunity needs.

To review the project rankings by category click the “Project Rankings” button on the Evaluation page or click the “Project Rankings” tab at the bottom of the spreadsheet (see Figure 12).



Project ID	Total Score	Project ID	Total Score	Project ID	Total Score
	All Equity Factors		Access to Opportunity		Health and Environment

Figure 12. Project rankings

The ranking process is followed by a review of the results to check for accuracy. Keep in mind that a slight difference between results may be insignificant due to measurement or other errors. It is also important to understand that the selection of categories, factors, and criteria, as well as the selection of data and evaluation methods during **Step 2: Select Scoring System and Methods** and **Step 3: Conduct the Evaluation**, could influence the results. After the review, agencies can confirm and select the list of projects for funding.

The selection process and results should be clearly communicated to stakeholders and the public. A variety of visualization tools including tables, maps, and charts could be used to convey the results.

3. Access to Opportunity

Access to opportunity is linked with mobility and accessibility. Particular focus is placed on how easy or difficult it is for historically underrepresented communities to access essential destinations and places of opportunity. The access to opportunity category aims to enhance COC’s ability to efficiently and safely access destinations offering education, employment, and community services. For the scorecard, access to opportunity is grouped into three main factors: access to employment, access to education, and access to community services and shopping areas.

3.1 Criteria

Table 2 illustrates the factors and criteria related to access to opportunity. To evaluate projects against those factors and criteria, identify the location of jobs, educational facilities, and community services (e.g., shopping, health care, daycare, parks, etc.) in relation to the project (use NAICS codes and local data).

Table 2. Access to Opportunity Factors and Criteria

Access to Opportunity	Employment	Project improves access to employment opportunities.
	Education	Project improves access to educational opportunities (e.g., higher education, job training, schools, daycare, after school programs).
	Community Services and Shopping	Project improves access to community services, including parks and recreational areas, and shopping areas.

3.2 Data Sources and Variables

Many factors can affect access to opportunity, such as modal options, transportation network connectivity, and land use proximity (Litman, 2016). These factors can be used to perform an accessibility analysis. Example data items and sources to measure access to opportunity are provided in Table 3.

Table 3. Access to Opportunity Data Items and Sources

Data Items	Sources
<ul style="list-style-type: none"> • Total employment for each block group • Number of workers by earning categories • Jobs within 45 minutes by auto • Transit to jobs accessibility index • Auto to jobs accessibility index 	Smart Location Database https://www.epa.gov/smartgrowth/smart-location-mapping#SLD and https://catalog.data.gov/dataset/smart-location-database-download
<ul style="list-style-type: none"> • Employment centers and other destinations* (educational facilities, community services, shopping centers, grocery stores, hospitals, etc.) 	United States Census Bureau LEHD Origin-Destination Employment Statistics (LODES) https://lehd.ces.census.gov/data/
<ul style="list-style-type: none"> • Worker characteristics data 	U.S. Bureau of Labor Statistics Employment Projections program https://www.bls.gov/emp/
<ul style="list-style-type: none"> • Occupation and industry data* 	North American Industry Classification System (NAICS) codes https://www.census.gov/eos/www/naics/
<ul style="list-style-type: none"> • Jobs Proximity Index (access to employment opportunities) 	U.S. Department of Housing and Urban Development https://hudgis-hud.opendata.arcgis.com/datasets/jobs-proximity-index
<ul style="list-style-type: none"> • Public Schools • Private Schools • Colleges and Universities • Child Care Centers • Supplemental Colleges • Truck Driving Schools • Hospitals • Major Sport Venues 	U.S. Department of Homeland Security (Homeland Infrastructure Foundation-Level Data (HIFLD)) https://hifld-geoplatform.opendata.arcgis.com/
*also evaluates health (access to health care and grocery stores)	

3.3 Methodology

Methods to evaluate access to opportunity range in complexity – from measures of proximity to advanced modeling. Although these methods could be applied across various modes, travel time and distance analysis should consider variations in travel time and distance for transit, bicycling, or walking. Considerations include whether the project continues or expands the existing bicycle/pedestrian or transit network or introduces new connections to essential destinations for traditional underserved areas.

Evaluation in Practice: The Atlanta Regional Commission (ARC)

The Atlanta Regional Commission (ARC) uses Open Trip Planner Analyst to estimate transit travel sheds for grade schools, grocery stores, higher education, hospitals, and libraries (see Table 4). The results of this estimation depend on the selected travel time period (ARC, 2017).

Table 4. ARC Access to Opportunity Evaluation

Agency	Atlanta Regional Commission (ARC)
Data Source	Open Trip Planner
Method	<p>GIS analysis and mapping</p> <ul style="list-style-type: none"> • Identify Equitable Target Areas (ETAs), defined as areas having a high concentration of Environmental Justice (EJ) communities. • Map locations of jobs, grade schools, grocery stores, higher education, hospitals, and libraries as points. • Use Open Trip Planner, which enables accessibility analysis using transit schedule information and route-finding algorithms, to create transit travel sheds around the point locations based on trip duration. • Assess how many of the ETAs are covered by the transit sheds using a 60 minute travel time for jobs, grade schools, higher education, hospitals, and libraries and a 30 minute travel time for grocery stores. For the estimation, the walking distance of 0.5 miles is assumed.

3.3.1 Basic Methods

Answer the following questions for each project:	
Does the project improve access to jobs?	No Yes
Does the project significantly increase the availability of safe and affordable travel options to major employers or areas with a high job density? Or does the project significantly decrease walking, biking, or transit travel time to a high job density location?	Yes, high impact
Does the project improve access to educational facilities?	No Yes
Does the project connect a high percentage of students to educational facilities? Or does the project significantly increase the availability of safe and affordable travel options to educational facilities? Or does the project significantly decrease walking, biking, or transit travel time to large educational facilities?	Yes, high impact
Does the project improve access to community services?	No Yes
Does the project significantly increase availability of safe and affordable travel options to nearby parks, recreational facilities, shopping areas, and other community services? Or does the project significantly decrease walking, biking, or transit travel time to community services and shopping areas?	Yes, high impact

Method

- Create a quarter-mile radius buffer around the project for walking and/or a one-mile radius buffer for biking.
- Identify areas with low- to high-concentrations of COCs (origins) and identify the locations of jobs, educational facilities, community services, and/or parks and recreational facilities (destinations) within the project buffer.
- Use the project description and GIS or other mapping tools to determine if the project connects or improves connections between these origins and destinations.

An example of the Access to Opportunity evaluation is provided in Figure 13. Additional information is provided in Appendix B.

34th Street, City of Tampa

Discussion: The project is within a ¼-mile of several educational facilities and essential destinations. The project description identifies proposed strategies to reduce traffic speeds and improve pedestrian and bicycle infrastructure.

Findings: Project elements have the potential to improve access to essential destinations and educational facilities within a ¼-mile of the project.

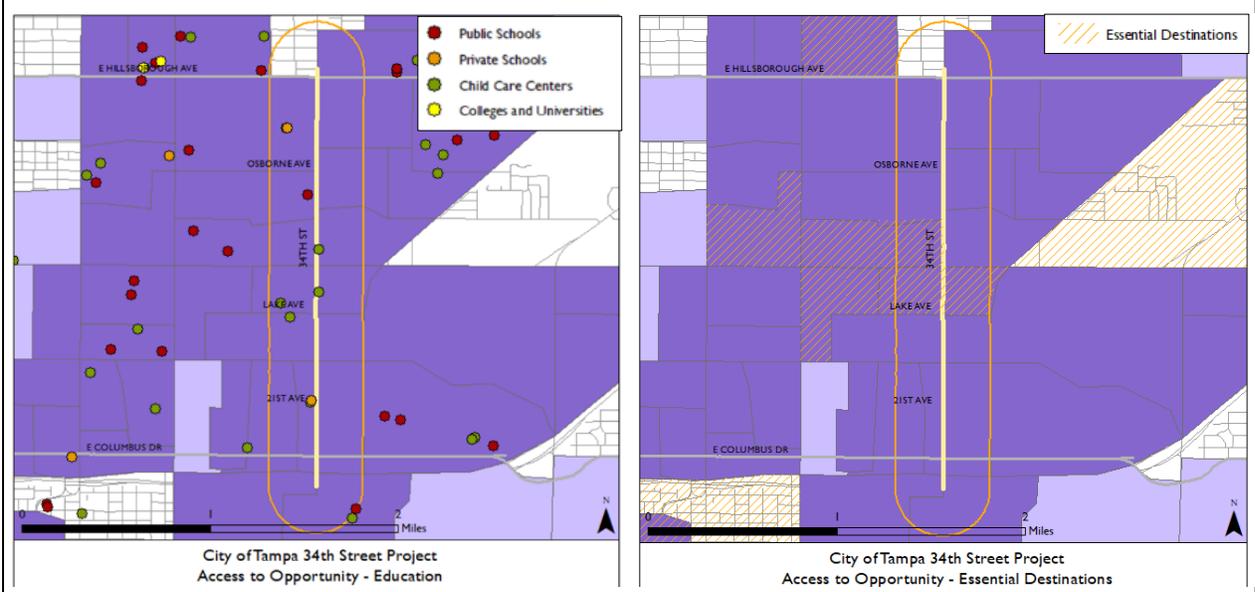


Figure 13. Access to opportunity evaluation

NOTE: See Mobility for improved transit service and/or access to opportunity.

3.3.2 Advanced Methods

More rigorous analysis may be conducted using the U.S. Bureau of Labor Statistics data, GIS, and/or travel demand models to identify the proportion of COCs benefiting from improved access to low entry barrier jobs.

Answer the following question:

Does the project improve access to low entry barrier jobs for COCs?

No
Yes

Identify low entry barrier living wage jobs

- Using occupational employment and job openings data and worker characteristics data of the Employment Projections program of the U.S. Bureau of Labor Statistics identify jobs with:
 - Positive projected growth
 - Median annual wage equal to or higher than the national median (or other locally determined criteria for a living wage)

- Educational requirements for entry that include
 - no formal educational credential,
 - high school diploma or equivalent, or
 - postsecondary non-degree award
- Less than five years of work experience required
- Calculate the percentage of jobs for each six-digit North American Industrial Classification System (NAICS) code that meet these criteria
- Identify locations and counts of jobs by industry
- Define the threshold for higher density of low entry barrier jobs (e.g., subzones with 10+, 20+, 30+, 40+, 50+)

Method A: GIS

- Estimate areas with low- to high-densities of COCs (origins) and low- to high-densities of low entry barrier jobs (destinations).
- Create a quarter-mile radius buffer around the project for walking and a mile-radius buffer for biking.
- Determine if the buffers overlap with at least one low- to high-density COC area and one medium- to high-density low entry barrier job destination.

Method B: Modeling/GIS

- Estimate the regional increase in the average number of low entry barrier jobs accessible to COCs within a given travel time (e.g., 30, 45 or 60 minutes) with the project (transit or auto).

Commentary

- Median hourly or annual income is commonly used as a proxy for living-wage jobs.

4. Health and Environment

Transportation planning and programming decisions have significant public health and environmental consequences. Auto-dependent infrastructure is associated with increased rates of obesity, heart disease, high blood pressure, as well as a loss of social connectedness (Ewing et al., 2014). As McLaughlin et al. (2014) acknowledge, population health is also adversely impacted by the decline in air and water quality.

Although vehicular emissions from transportation can cause adverse health effects, active transportation has been suggested as an effective alternative in addressing these concerns (Morabia et al., 2019; Rojas-Rueda, 2019; Wu et al., 2019). Additionally, projects that promote alternative fuel and electric vehicles have the potential to reduce the adverse effects of transportation in the future. For the scorecard, health and environment are grouped into three main factors: health care, healthy food, and environment. Each factor is related to a specific project prioritization objective.

4.1 Criteria

The health and environment factors and criteria are included in Table 5. The criteria aim to improve connectivity and accessibility to health care services and healthy food and improve livability through the built environment.

Table 5. Health and Environment Factors and Criteria

Health and Environment	Health Care	Project improves access to health care services.
	Healthy Food	Project connects to grocery stores or markets that provide healthy and fresh food at affordable prices.
	Environment	Project increases livability (e.g., community cohesion, streetscaping, green infrastructure, etc.) through design and/or mitigation measures.

4.2 Data Sources and Variables

Data to evaluate if a project meets the health and environment criteria include national, local, and regional data, such as Smart Location Database, U.S. Census data, United States Department of Agriculture (USDA), modeling data, and available project information. Example data items and sources for the health and environment factors are identified in Table 6.

Table 6. Health and Environment Data Items and Sources

Data Items	Sources
<ul style="list-style-type: none"> Street landscape information 	Local or regional agency (unique to the area)
<ul style="list-style-type: none"> Food access data 	United States Department of Agriculture (USDA) Economic Research Service https://www.ers.usda.gov/data-products/food-access-research-atlas/.aspx
<ul style="list-style-type: none"> Environmental Health Hazard Index* 	U.S. Department of Housing and Urban Development https://hudgis-hud.opendata.arcgis.com/datasets/environmental-health-hazard-index
<ul style="list-style-type: none"> Emissions density* 	Travel demand model (unique to the region)
*also evaluates burdens	

4.3 Methodology

A growing number of MPOs measure and evaluate the health impacts of their planning and programming using a variety of indicators and approaches. For example, MPOs identify the proximity of COCs to air pollution sources (SANDAG, 2012) or estimate emission density or vehicle miles traveled (VMT) density (VMT per square mile) using models and then compare the results for COCs and non-COCs (MTC, 2013). Another method used to assess health impacts on COCs is to estimate the share of affordable housing within a specific distance (e.g., 500 feet) of high-volume roadways.

Regarding positive health impacts, several MPOs consider active transportation projects as necessary for healthy communities. The share of non-motorized travel modes in communities can be estimated using travel demand models or other approaches. Generally, bicycle, pedestrian, or transit projects have a positive effect on quality of life, energy conservation, and the environment.

Evaluation in Practice: The Association of Bay Area of Governments (ABAG) and Metropolitan Transportation Commission (MTC)

The Association of Bay Area of Governments (ABAG) and Metropolitan Transportation Commission (MTC) in the San Francisco Bay area, use models, off-model methods, and scenarios for base-year and future-year conditions to measure emissions density and VMT density and to estimate emissions distribution index by pollution and community type (see Table 7).

Table 7. ABAG and MTC Health and Environment Evaluation

Agency	ABAG and MTC
Data Source	Model data
Method	<p>Modeling</p> <ul style="list-style-type: none"> • Measure emissions density and VMT density. <ul style="list-style-type: none"> ○ The VMT density measure is intended to quantify the effects of VMT in and near communities. It is a measure of the total VMT on major roadways located in or near residential and commercial areas; the result is expressed as an average VMT per square kilometer of developed land within 1,000 feet of major roadways. ○ As a related measure, vehicle emissions were also estimated and analyzed. • Estimate emissions distribution index by pollution and community type, including COCs. <ul style="list-style-type: none"> ○ The overall distribution of regional VMT relative to the regional population in the various scenarios is estimated. This distribution index also represented as a ratio between each community type’s share of total regional VMT to each community type’s share of the total regional population.

4.3.1 Basic Methods

Answer the following questions for each project:	
Does the project improve access to health care?	No Yes
Does the project significantly increase the availability of safe and affordable travel options to a hospital or other health care facilities? Or does the project significantly decrease walking, biking, or transit travel time to a hospital or other health care centers? Or does the project significantly improve public health in areas where residents have health outcome disparities, including asthma, obesity, or diabetes?	Yes, high impact
Does the project improve access to grocery stores or markets with healthy and fresh affordable food?	No Yes
Does the project significantly increase the availability of safe and affordable travel options to a fresh produce market or grocery store? Or does the project significantly decrease walking, biking, or transit travel time to a fresh produce market or grocery store?	Yes, high impact
Does the project increase livability through design and/or mitigation measures?	No Yes
Does the project significantly reduce noise level, emission rate, or vehicle miles traveled, and/or accomplish two or more of the following? 1. Reinforce community cohesion 2. Improve landscaping and/or includes green infrastructure 3. Provide street furniture 4. Provide LED or solar lighting 5. Incorporate art or cultural amenities	Yes, high impact

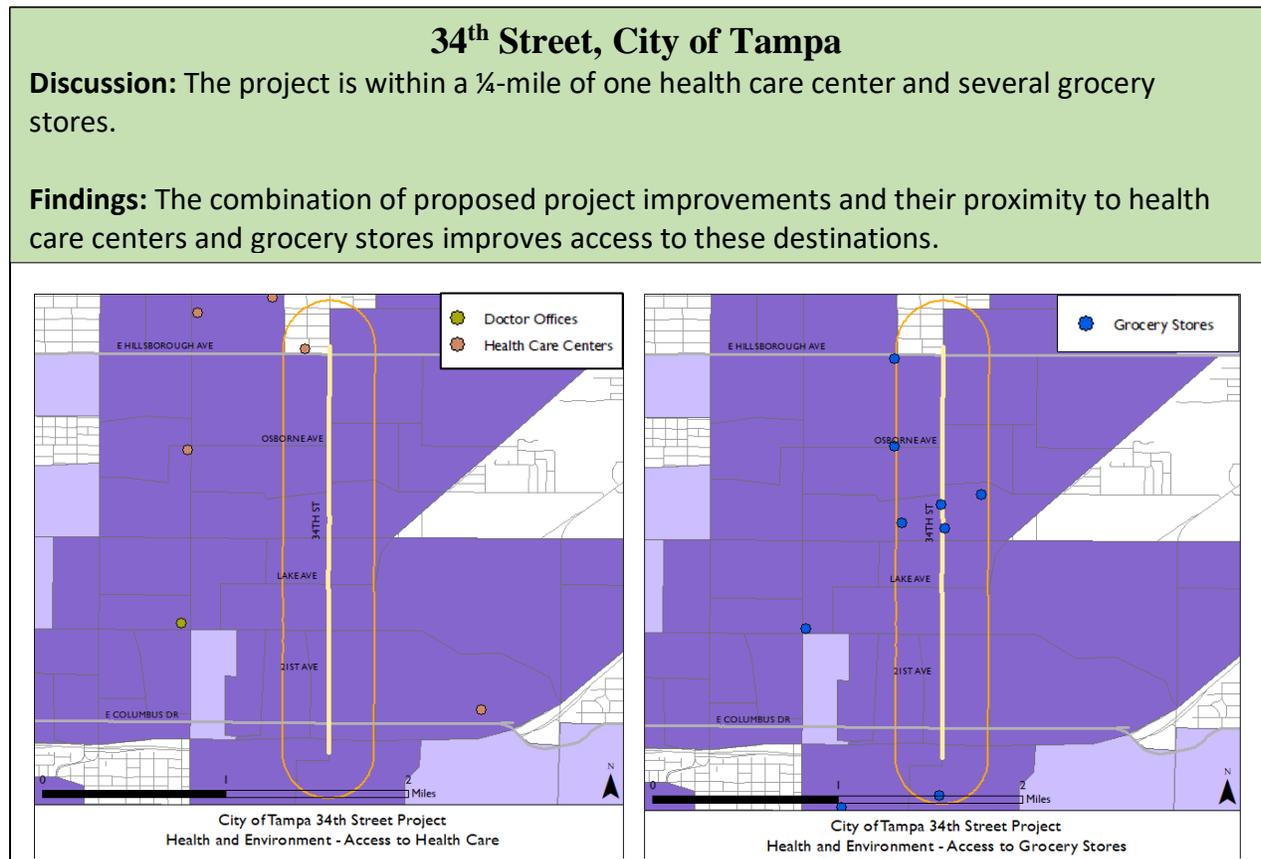
Health

Identify the location of health care and healthy food sources (e.g., fresh produce) in relation to the project (GIS analysis of existing uses using NAICS codes and other local data).

Method

- Create a quarter-mile radius buffer around the project for walking and/or a one-mile radius buffer for biking.
- Identify areas with low- to high-concentrations of COCs (origins) and identify the locations of health care centers and grocery stores providing healthy food options (destinations) within the project buffers.
- Determine if the project connects or improves connections between these origins and destinations.

An example of the Health evaluation is provided in Figure 14. Additional information is provided in Appendix B.



Environment

Identify measures that promote livability by improving community cohesion, enhancing aesthetics (streetscaping, green infrastructure, etc.), and reducing noise and air pollution.

Method:

- Review the project description
- Collect and analyze additional data from public involvement, field study, observational studies, or other sources
- Determines if the project addresses one or more of the following:
 - Community cohesion
 - Aesthetics
 - Noise reduction
 - Air quality improvement

4.3.2 Advanced Methods

Environment

Answer the following question:	
Does the project reduce noise level or improve air quality?	No Yes

Method: Modeling

- Estimate transportation noise level before and after the project (e.g., Federal Highway Administration (FHWA) transportation noise model) to determine the percentage of the population that would experience reduce road traffic noise because of the project.

OR

- Estimate the distribution of vehicle miles traveled (VMT) for COCs relative to the rest of the region before and after the project.

5. Safety and Emergency Evacuation

Transportation safety and emergency evacuation are fundamental to the health and wellbeing of transportation system users. High crash locations often correspond with areas with large proportions of COCs (DVRPC, 2018; Hagen, 2011; Williams and Golub, 2017) and therefore it is necessary to identify and mitigate these disproportionate impacts. Emergency evacuation (e.g., flood or hurricane) is especially important in high-hazard areas and areas with vulnerable populations. In the transportation equity scorecard, safety and emergency evacuation are grouped into two factors: improved safety and improved emergency evacuation.

5.1 Criteria

The criterion for high-crash locations has a focus on vulnerable road users, including pedestrians and bicyclists. The emergency evacuation criterion ensures that useful emergency preparedness projects get prioritized for funding in areas with a large concentration of COCs. Table 8 shows the safety and emergency evacuation factors and criteria.

Table 8. Safety and Emergency Evacuation Factors and Criteria

Safety and Emergency Evacuation	Safety	Project improves safety for pedestrians and bicyclists at high-crash locations.
		Project improves safety at other (non-high crash) locations.
	Emergency Evacuation	Project improves emergency evacuation (e.g., transit coordination, connections to shelters, etc.).

5.2 Data Sources and Variables

Traffic crash data collected by Departments of Transportation (DOTs) or local or regional government staff are commonly used for the safety analysis. Street design and the built environment influence safety conditions and can either facilitate or hinder emergency evacuation. Therefore, information about the transportation network design, which may help identify appropriate safety or emergency evacuation measures, provides important data in this evaluation. Example data items and sources for the safety and emergency evacuation evaluation of projects are available in Table 9.

Table 9. Safety and Emergency Evacuation Data Items and Sources

Category	Data Items	Sources
Safety	<ul style="list-style-type: none"> Crash data by fatality, severity, and modes 	Local, regional, or state agencies
	<ul style="list-style-type: none"> Safety countermeasures 	U.S. Department of Transportation https://safety.fhwa.dot.gov/provencountermeasures/
Emergency Evacuation	<ul style="list-style-type: none"> National Shelter System Facilities Emergency Medical Service (EMS) Stations Hurricane Evacuation Routes State Emergency Operations Centers (EOC) 	Homeland Infrastructure Foundation-Level Data (HIFLD) https://hifld-geoplatform.opendata.arcgis.com/datasets/

5.3 Methodology

Although all methods to evaluate safety and emergency evacuation are not targeted to COCs, they can be adapted for that purpose. Travel demand models are used to estimate VMT and evaluate exposure to crashes. To identify high-crash areas, a preliminary needs assessment is conducted to estimate the percentage of crashes by mode, severity, and area. This is usually followed by an advanced needs assessment to evaluate the cause of crashes in high-crash locations. The needs assessment is followed by project prioritization to consider safety countermeasures in project proposals.

Regarding emergency evacuation, several Florida MPOs prioritize projects that improve an identified evacuation route on the state evacuation route maps. In addition to prioritizing projects that improve evacuation routes, other project considerations can include improved transit service availability and operation during an emergency, or other project components that enhance emergency evacuation.

Evaluation in Practice: Metro

During the safety evaluation, Metro, in Portland, Oregon, uses models to measure the exposure of COCs to crashes (see Table 10).

Table 10. Metro Safety Evaluation

Agency	Metro
Data Source	Model data
Method	Modeling <ul style="list-style-type: none"> • Identify regional vehicle miles traveled (VMT) in each TAZ • Measure changes above a certain threshold with the proposed package of transportation investments. • Employ a travel demand model and estimate the difference in exposure to VMT in TAZ's with higher concentrations of historically marginalized communities compared to other TAZs.

5.3.1 Basic Methods

Answer the following questions for each project:	
Does the project implement appropriate safety countermeasures for pedestrians and bicyclists at high-crash locations?	No Yes
Does the project integrate two or more safety countermeasures, such as protected bicycle lanes, raised median islands, Rectangular Rapid Flash Beacon (RRFB) or other signalized midblock crossing treatments, roundabouts, lane reductions, traffic calming, street lighting, etc., at high-crash locations? Or does the project significantly decrease pedestrian and bicycle crash rates per capita at high-crash locations?	Yes, high impact
Does the project implement appropriate safety countermeasures at other (non-high crash) locations?	No Yes
Does the project integrate two or more safety countermeasures, such as protected bicycle lanes, raised median islands, Rectangular Rapid Flash Beacon (RRFB) or other signalized midblock crossing treatments, roundabouts, lane reductions, traffic calming, street lighting, etc., at other (non-high crash) locations? Or does the project significantly decrease crash rates per capita at other (non-high crash) locations?	Yes, high impact
Does the project improve emergency evacuation?	No Yes
Does the project greatly improve coordination of and access to emergency evacuation services and opportunities? Or does the project significantly decrease travel time to shelters?	Yes, high impact

Safety

Method

- Identify high-crash block groups: COC block groups with pedestrian and bicycle crash rates per capita greater than one standard deviation above the countywide average.
- Review the project description to identify proposed safety countermeasures. Evaluate proposed safety countermeasures for appropriateness using FHWA's list of Proven Safety Countermeasures: <https://safety.fhwa.dot.gov/provencountermeasures/>

Emergency Evacuation

Method

- Create a quarter-mile radius buffer around the project for walking and/or a one-mile radius buffer for biking.
- Identify shelters and emergency routes within the project buffer.
- Review the project description to identify proposed project features. Based on the availability of shelters and emergency routes and proposed project features, determine if the project improves emergency evacuation.

An example of the Emergency Evacuation evaluation is provided in Figure 15. Additional information is provided in Appendix B.

34th Street, City of Tampa

Discussion: The project is a safety project within a ¼-mile of a national shelter facility and an EMS station. Roundabouts, which have been found to keep through-traffic flowing during an emergency, are proposed as key elements of the project.

Findings: The project type and proposed elements, in combination with their proximity to the shelter and EMS station, improve access to these facilities.

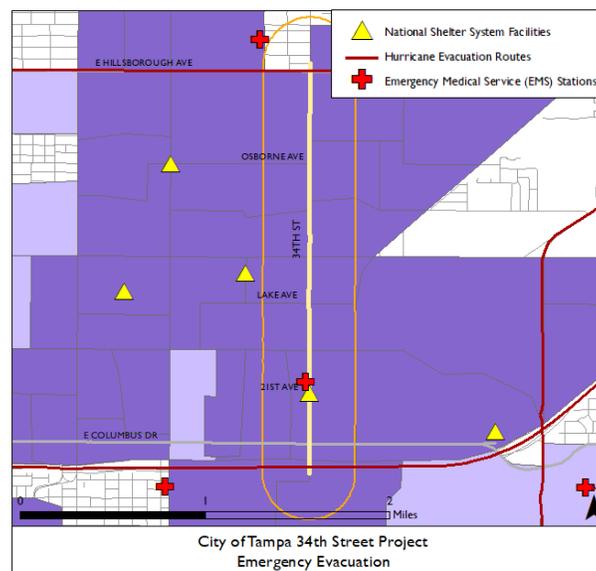


Figure 15. Emergency evacuation evaluation

5.3.2 Advanced Methods

Safety

Answer the following question:	
Does the project reduce traffic fatalities or exposure to crashes?	No Yes

Method: Modeling

- Estimate traffic fatalities for pedestrians, bicyclists, and vehicles before and after the project.
OR
- Estimate VMT in each TAZ using a travel demand model and compare VMT before and after the project.

6. Affordability

According to the Bureau of Transportation Statistics (2018), housing (33.2%) and transportation (17.4%) account for the two largest categories of average individual household expenditures. Mixed-use development with a rich array of transportation options often lacks affordable housing. Affordable housing near employment locations and activity centers are particularly scarce in some regions.

Research demonstrates that the challenge associated with housing and transportation costs is typical for lower-income households and households of color. In large metropolitan areas, racial and income inequalities exacerbate the already significant mismatch between affordable housing and transit access (Kramer, 2018). Therefore, a growing number of MPOs are starting to include affordability criteria in their project prioritization process to ensure that investments help reduce costs.

6.1 Criteria

Affordability factors and criteria are highlighted in Table 11. Affordability is grouped into three factors: housing and transportation costs, housing, and transportation.

Table 11. Affordability Factors and Criteria

Affordability	Housing and Transportation Costs	Project decreases the share of household income consumed by transportation and housing.
	Housing	Project improves access to and from affordable housing.
	Transportation	Project increases availability of affordable transportation options.

NOTE: Due to its extensive data and analysis needs, “Housing and Transportation Costs” may be skipped during the evaluation process.

6.2 Data Sources and Variables

The Center for Neighborhood Technology (CNT) housing and transportation cost index is a commonly used source for the affordability analysis. Travel demand model data may be used to estimate travel time costs and other transportation-related costs for existing and future conditions. Data from the U.S. Census Bureau can help identify low-income households and households with high financial burdens. Table 12 provides example data items and sources to evaluate how projects could improve transportation and housing affordability.

Table 12. Affordability Data Items and Sources

Data Items	Sources
<ul style="list-style-type: none"> • H+T Index 	Center for Neighborhood Technology http://htaindex.cnt.org/
<ul style="list-style-type: none"> • Public Housing Buildings • Multifamily Properties Assisted • Low Income Housing Tax Credit Properties • Housing Choice Vouchers by Tract • Low Transportation Cost Index • Location Affordability Index 	U.S. Department of Housing and Urban Development http://hudgis-hud.opendata.arcgis.com/datasets/
<ul style="list-style-type: none"> • Travel time savings and out-of-pocket trip costs (e.g., average transportation cost per household) • Household cost-saving compared to base year • Share of household income 	Travel demand model (unique to the region)

6.3 Methodology

Affordability is measured by combining average housing and transportation costs and dividing the total by average income. MTC and ABAG in the San Francisco Bay Area and Metro in Portland, Oregon used this metric and set the target to no more than 40 percent of household income.

Assessment in Practice: The San Diego Association of Governments (SANDAG)
 The San Diego Association of Governments (SANDAG) employs the percent of households with housing costs greater than 35 percent of income as part of their affordability indicators (SANDAG, 2019).

6.3.1 Basic Methods

Answer the following questions for each project:	
Does the project decrease the share of household income consumed by transportation and housing?	No Yes
Does the project reduce housing and transportation costs as a percent of income to 30 percent or less?	Yes, high impact
Does the project reduce travel time or eliminate a barrier to/from affordable housing?	No Yes
Does the project provide direct connections to affordable housing through premium transit service, a protected bicycle facility, or new/connected sidewalks or shared use paths? Or does the project significantly decrease travel time to and from affordable housing?	Yes, high impact
Does the project provide affordable transportation choices, especially in areas with a high transportation cost?	No Yes
Does the project provide premium and affordable transit or protected and connected bike facility or new/connected sidewalk or increase the availability of high quality and affordable transportation options?	Yes, high impact

Housing and Transportation Costs

Method

- Create a quarter-mile radius buffer around the project for walking and/or a one-mile radius buffer for biking.
- Identify affordable housing and calculate the housing and transportation cost within the buffer.
- Review the project description for proposed affordable transit service or pedestrian/bicycle infrastructure. Determine if the project connects to affordable housing, is in an area without an affordable transportation system, and is in an area with high housing and transportation costs as a percent of household income (e.g., use available national affordability GIS layers).

Housing

Method

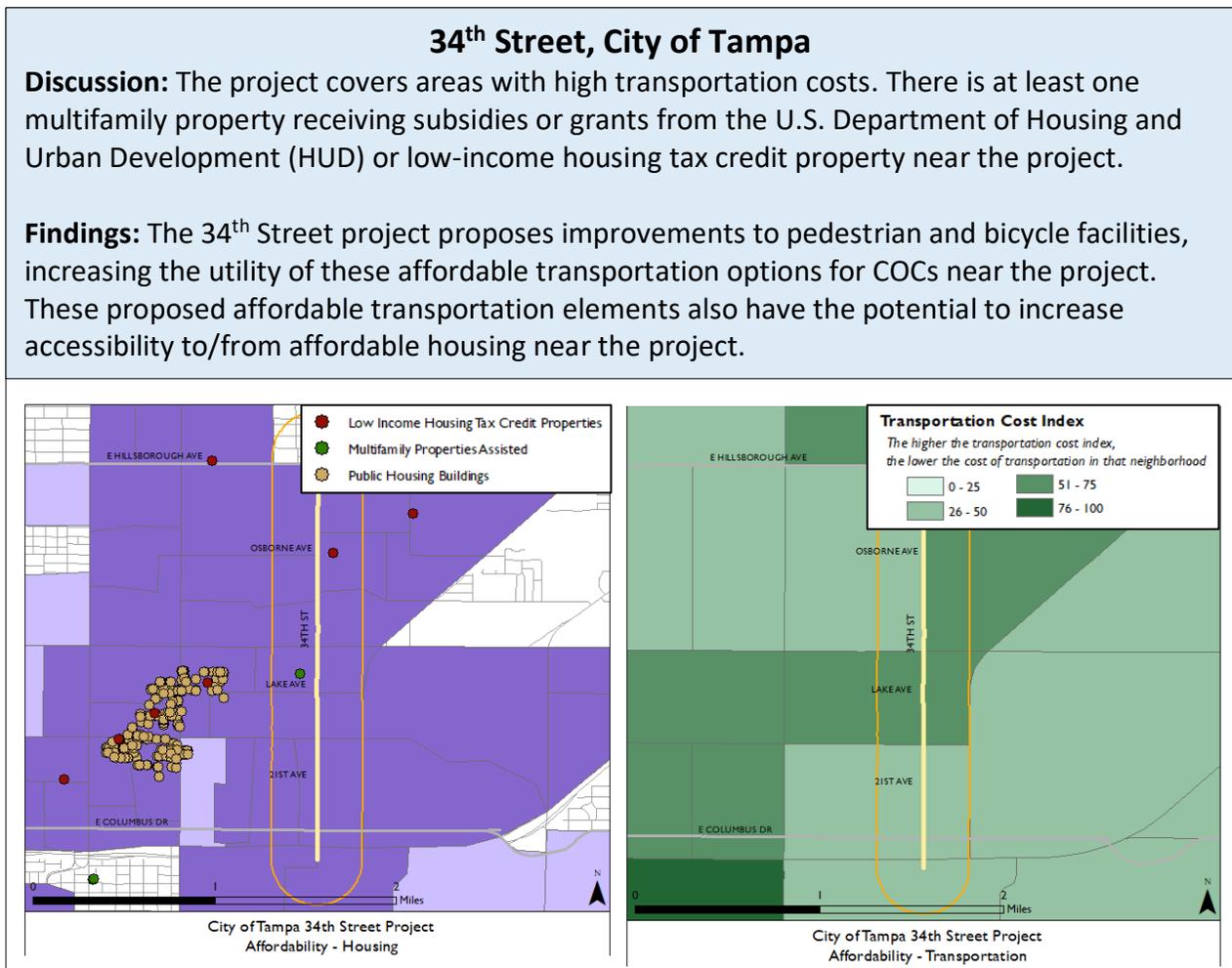
- Create a quarter-mile radius buffer around the project for walking and/or a one-mile radius buffer for biking.
- Identify affordable housing within the buffer.
- Review the project description to identify proposed improvements.
- Use GIS and/or other mapping tools to determine if the project connects to affordable housing.

Transportation

Method

- Create a quarter-mile radius buffer around the project for walking and/or a one-mile radius buffer for biking.
- Use available data from sources, such as the transportation cost index, to determine the transportation affordability near the project.
- Review the project description to determine if the project is adding affordable transit service or pedestrian/bicycle infrastructure within a ¼-mile and/or 1-mile of areas with low transportation affordability.

An example of the Affordability evaluation is provided in Figure 16. Additional information is provided in Appendix B.



6.3.2 Advanced Methods

Housing and Transportation Costs

Answer the following question:	
Does the project reduce combined housing and transportation costs as a percent of household income?	No Yes

Method:

- Use a travel demand model to estimate combined housing and transportation costs as a percentage of household income before and after the project.

7. Mobility

Although mobility overlaps with several other equity categories, it is considered a separate category in the equity scorecard tool due to its broad impacts. For example, traffic delay and congestion, which are important mobility indicators, are also considered in the evaluation of access to jobs and services. Quality and level of service (Q/LOS) are other measures to assess mobility impacts of the transportation system for the various modes. Equity and mobility can be improved through projects that reduce travel time for transit and single-occupancy vehicles, reduce vehicle miles traveled for COCs, and provide or supplement active transportation options available to COCs.

7.1 Criteria and Objectives

The Mobility category includes three mobility factors: active transportation, transit access, and ADA. It should be noted that active transportation also advances health and the environment; as a result, the evaluation of the active transportation criterion should consider health and environmental factors, discussed in Chapter 4. Factors and criteria for Mobility are shown in Table 13.

Table 13. Mobility Factors and Criteria

Mobility	Active Transportation	Project improves or expands bicycle or pedestrian facilities.
	Transit Access and Service	Project improves transit service and/or access, including first- and last-mile access.
	Americans with Disabilities Act (ADA)	Project improves accessibility for persons with disabilities (e.g., transit stops, ADA curb ramps, audio-visual signals, driveway grade, etc.).

7.2 Data Sources and Variables

Data from travel demand models, project studies, and local, regional, and transit agency datasets are needed to assess mobility. Data from project studies explaining the project objectives can be used to identify how the project is anticipated to enhance mobility. Example data items and sources for mobility are provided in Table 14.

Table 14. Mobility Data Items and Sources

Data Items	Sources
<ul style="list-style-type: none"> • Walkability index* 	U.S. Environmental Protection Agency Walkability Index https://catalog.data.gov/dataset/walkability-index
<ul style="list-style-type: none"> • Network density in terms of facility miles of pedestrian-oriented links per square mile (D3apo, NAVSTREETS)* 	Smart Location Database https://www.epa.gov/smartgrowth/smart-location-mapping#SLD and https://catalog.data.gov/dataset/smart-location-database-download
<ul style="list-style-type: none"> • Pedestrian and bicycle network information* • Bus stop locations * • Transit service and network information* 	Local, regional, and transit agencies (unique to the region)
<ul style="list-style-type: none"> • Transit schedule information * • Transit route finding algorithms* • Transit trip duration* • Transit travel time period* 	Open Trip Planner Analyst https://www.opentripplanner.org/
<ul style="list-style-type: none"> • Fixed Guideway Transit Stations • Public Transit Stations • Public Transit Routes • Stations and Transfers • Trails • Amtrak Stations • Railroads 	Homeland Infrastructure Foundation-Level Data (HIFLD) https://hifld-geoplatform.opendata.arcgis.com/datasets/
<ul style="list-style-type: none"> • Origin and destination information • Current and forecasted travel time, speed, and distance • Network volume, capacity, or vehicle miles travel (VMT)* 	Travel demand model (unique to the region)

*also evaluates health and environment and/or access to opportunity

7.3 Methodology

Several MPOs include mobility, congestion, and reliability criteria in their project prioritization processes. ARC defines mobility as “the ability to move people or goods from place to place” (ARC, 2017). For example, ARC evaluated projects by mode using the mobility and congestion criterion and asked “how do you get somewhere” and “how fast can you travel there” using various modes (ARC, 2017).

The Boston Region MPO has a similar definition of mobility and considers mobility for COCs when prioritizing groups of projects in the Long-Range Transportation Plan. The MPO ensures that projects reduce transit vehicle delay and vehicle congestion. During the project

prioritization process, transit and highway production and attraction times for average door-to-door travel time are estimated for each TAZ (Boston Region MPO, 2018).

Assessment in Practice: Polk TPO

Polk TPO, in Central Florida, conducts mobility audits to identify mobility needs for COCs. During this process, walking and biking access, transit connectivity, gaps in the multimodal transportation network, barriers to walking and biking, and overall mobility are evaluated. Table 15 explains the Polk TPO’s approach to the mobility audits. Results from the audits are used to identify community needs during the project prioritization process.

Table 15. Polk TPO Mobility Evaluation

Agency	Polk TPO	
Data Source	GIS and Public Feedback	
Method	Walking Access	This index assesses the potential for quarter-mile walking trips to community services and places.
	Biking Access	This index assesses the potential for one-mile biking trips to community services and places.
	Transit Connectivity	This index assesses the potential for transit access to community services and places by looking at the location, intensity, and frequency of transit service in the area.
	Gaps	This metric assesses the presence of transportation network gaps, specifically sidewalk network gaps, which may hinder the potential for walking or biking trips to community services and places.
	Barriers	This metric assesses the presence of three features that may hinder the potential for walking or biking trips to community services and places.
	Mobility	This metric summarizes the overall mobility within each neighborhood and the level of mobility assigned based on the cumulative score.

Source: Polk County TPO, 2015; Williams and Golub, 2017

7.3.1 Basic Methods

Answer the following questions for each project:	
Does the project improve or expand bicycle or pedestrian facilities?	No Yes
Does the project accomplish one or more of the following? <ul style="list-style-type: none"> Provides new protected bicycle facility or shared use path Introduces new signalized crosswalks (e.g., rectangular rapid flashing beacon, pedestrian hybrid beacon) Significantly decreases walking and biking travel time 	Yes, high impact
Does the project improve transit service or access, including first mile/last-mile access? Select yes if the project addresses one or more of the following: <ul style="list-style-type: none"> Improves first/last-mile connections to transit stops or routes Expands service frequency and/or hours of operation Adds transit stops or routes Provides transit shelters 	No Yes
Does the project accomplish one or more of the following? <ul style="list-style-type: none"> Provides premium transit service (e.g., BRT, Rail, express, etc.) Reduces transit travel times (e.g., signal priority, queue jump, dedicated lanes, etc.) Provides other user enhancements (e.g., real-time transit information, mobile transit apps, etc.) 	Yes, high impact
Does the project include special measures to improve accessibility for persons with disabilities? Select yes if the project addresses one or more of the following: <ul style="list-style-type: none"> Transit stop accessibility (e.g., continuity of pedestrian network/access, etc.) Audio-visual signals Driveway grade reconstruction/driveway removal Other 	No Yes
Does the project significantly improve accessibility in areas identified as a high priority for access improvement/compliance in an ADA Transition Plan or in areas with a high percentage of persons with disabilities?	Yes, high impact

Active Transportation

Method:

- Map or inventory pedestrian and bicycle facilities.
- Map pedestrian and bicycle network gaps within a ¼-mile radius of COCs.
- Review the project description to determine if the project will close any network gaps and/or add bicycle/pedestrian facilities.
- Estimate the percentage of completed bicycle and pedestrian gaps before and after the project.

NOTE: Many areas lack complete data on sidewalk coverage

NOTE: See also Access to Opportunity for consideration of improved access to essential destinations.

Commentary

- A ¼-mile is a nationally accepted standard for walking distance. The ¼-mile radius is a relatively conservative measure. Transportation mode and population age and ability should be used to identify an appropriate measure for this evaluation.
- Some local governments have Q/LOS standards relative to bicycle and pedestrian networks on certain types of roadways for use in rating facilities.
- Individuals vary on how far they are willing to walk or ride a bicycle. This methodology aims to identify whether a project helps to reduce a common barrier to walking and cycling – a lack of safe and continuous facilities. Other barriers include extreme weather conditions, distance, wayfinding concerns, and work attire (see, for example, Arlington County Commuter Services, Walking and Biking Barriers Study, June 30, 2017, https://1105am3mju9f3st1xn20q6ek-wpengine.netdna-ssl.com/wp-content/uploads/2017/11/ACCS-Final-Report_Walking-and-Biking-Barriers-Study.pdf).
- Local residential streets are generally considered a part of the bicycle network, regardless of the presence of bicycle lanes.

Transit Access and Service

Method A: First/Last-Mile Access

- Identify bicycle network gaps within a 2-mile radius of transit stops/routes.
- Identify pedestrian network gaps within a ½ mile of transit stops and stations.
- Review the project description to determine if the project will close any network gaps and/or add bicycle/pedestrian facilities around transit routes/stops and/or implement other affordable strategies to enable first and last-mile transit access.
- Estimate the percent of completed bicycle and pedestrian gaps around transit stops before and after the project.

Method B: Transit Service

- Review the project description
- Determine if the project proposes to improve transit operation (e.g., does the project propose to add stops or increase service frequency?)

American's with Disabilities Act (ADA)

Method

- Analyze project details to determine if it includes special measures to improve accessibility for persons with disabilities, including correcting existing deficiencies.

An example of the Mobility evaluation is provided in Figure 17. Additional information is provided in Appendix B.

34th Street, City of Tampa

Discussion: Proposed project elements include bicycle facilities and new sidewalks and pedestrian ramps at roundabouts. A transit route (HART Bus Route 5) is along 34th Street and bicycle and pedestrian improvements are proposed in the vicinity of the transit stops.

Findings: The project includes active transportation improvements, which have the potential to improve transit access, including first-mile/last-mile access, in the vicinity of transit stops.



Figure 17. Mobility evaluation

7.3.2 Advanced Methods

Active Transportation

Answer the following question:	
Does the project increase the percent of residents using active transportation?	No Yes

Method

- Estimate the percentage of people who travel via active transportation modes, such as public transportation, walking, or bicycling, and/or transit before and after the project.

Transit Access and Service

Answer the following question:	
Does the project improve the average commute time for transit riders?	No Yes

Method

- Estimate transit travel time before and after the project.

8. Burdens

The overall goal of the scorecard tool is to identify and prioritize projects that are beneficial to COCs. This analysis would be incomplete without an evaluation of potential burdens. Examples of burdens include cumulative or disproportionate impacts, barriers, and increased noise or emissions.

Cumulative impacts are “the aggregate result of the incremental direct and indirect effects of a project or plan, the effects of past and present actions, and effects of reasonably foreseeable future actions by others on resources of concern” (AASHTO, 2016, p. 1). Disproportionate impacts typically encompass EJ concerns and are defined as extensive differences in impacts or risks across population groups (EPA, 2016).

Barriers include any physical obstacles, such as major multi-lane roadways, that dissect communities and lessen community cohesion. These barriers relate to several of the equity assessment categories, including access to opportunity, health and environment, safety and emergency evacuation, and mobility. Noise pollution and emissions are related to the health and environment category, but warrant inclusion as a burden due to their potential to cause long-term negative impacts on COCs.

While some MPOs discontinue projects that cause adverse impacts, others introduce mitigating measures to address these impacts. In the scorecard, burdens are given a score of negative ten (-10) or negative twenty (-20), ensuring that projects with significant adverse impacts are not prioritized higher than projects with minimal or no adverse impacts.

8.1 Criteria and Objectives

The burdens category has one factor, “adverse impacts”. Specific criteria for each MPO will vary based on project type, geography, historic trends, public input, and other details unique to the project and COC. Project information and other data can be used to create a list of projects- and community-specific burdens. Table 16 shows the factor and criterion related to Burdens.

Table 16. Burdens Factor and Criterion

Burdens	Adverse Impacts	Project causes cumulative, disproportionate, or other major adverse impacts.
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8.2 Data Sources and Variables

Information about the project is necessary to evaluate the Burdens category and identify potential adverse impacts caused by the project. For example, the proposed number of lanes, roadway width, or other proposed elements that may cause barriers can be identified using the

project information. Possible mitigating measures may also be identified in the project description.

Cumulative and disproportionate impacts can be evaluated using historic data including maps, plans and studies, and other qualitative sources. Other impacts, including noise pollution and vehicular emissions, can be evaluated using regional data, modeling, and other quantitative sources. Table 17 synthesizes example data items and sources to assess adverse impacts.

Table 17. Burdens Data Items and Sources

Data Items	Sources
<ul style="list-style-type: none"> • Historic trends • Existing resources • Timeline of changing conditions 	<ul style="list-style-type: none"> Historic records and maps Archived plans and studies Community feedback Staff input Maps of current conditions

8.3 Methodology

Burdens and adverse impacts can take many forms and there is no standardized methodology or performance measure currently established to assess these impacts. Nonetheless, the methods employed by a particular agency to evaluate burdens should be clear to both decision-makers and the general public.

Several MPOs evaluate projects for adverse impacts and compliance with EJ requirements. For example, Broward MPO (2018) evaluates projects for physical and economic impacts on residences and businesses. The MPO ensures that projects that have an adverse effect on COCs are eliminated, altered, or reprioritized. Florida-Alabama TPO (2018) evaluates if a project has gone through a Project Development and Environment (PD&E) Study and/or DOT consultant review and has no adverse impacts. Other methods include Environmental Impact Studies (EIS), Environmental Impact Assessment (EIA), and processes from the National Environmental Policy Act (NEPA).

Assessment in Practice: ABAG and MTC

MTC and ABAG, in the San Francisco Bay area, use model approach, off-model methods, and scenarios for base-year and future-year conditions to evaluate emission exposure (ABAG and MTC, 2013). The analysis evaluates emissions two ways: (1) measuring emissions density and VMT density and (2) estimating the emissions distribution index by pollution and community type.

Table 18 shows ABAG and MTC’s approach to evaluate emission exposure

Table 18. ABAG and MTC Emission Exposure Evaluation

Agency	MTC and ABAG
Data Source	Model data
Method	<p>Modeling</p> <ul style="list-style-type: none"> • Measure emissions density and VMT density. The VMT density measure is intended to quantify the effects of vehicle-miles of travel (VMT) in and near communities. It is a measure of the total VMT on major roadways located in or near residential and commercial areas; the result is expressed as an average VMT per square kilometer of developed land within 1,000 feet of major roadways. As a related measure, vehicle emissions are also estimated and analyzed. • Estimate the emissions distribution index by pollution and community type, including COCS. The index is an estimate of the overall distribution of regional VMT relative to regional population in the various scenarios. This distribution index is also represented as a ratio between each community type’s share of total regional VMT to each community type’s share of total regional population.

8.3.1 Basic Methods

Answer the following questions for each project:	
<ul style="list-style-type: none"> • Does the project cause cumulative, disproportionate, or other major adverse impacts? Select yes if the project causes any of the following: <ul style="list-style-type: none"> ○ Creation of a physical barrier ○ Change in travel time ○ Disruption of access to neighborhood/community services and facilities ○ Increased noise level ○ Displacement of residents, businesses, or public amenities ○ Reductions in safety and personal security ○ Increased emissions and reduced air quality ○ Diminished aesthetics, and ○ Increased effects over time 	No Yes
<ul style="list-style-type: none"> • Does the project cause significant adverse impacts? Select yes if the project causes any of the following: <ul style="list-style-type: none"> ○ Significant barrier effects (e.g., widen from 4 to 6 lanes, high speed, increases traffic volumes, grade separation, etc.) ○ Significant cumulative/disproportionate impacts ○ Increases the displacement of residents, businesses, or public amenities ○ Reduces business revenue and employment (e.g., by relocating businesses) ○ Greatly increases noise or emissions ○ Reduces safety and personal security 	Yes, high impact

Method

- Analyze project details to identify if the project introduces any barriers (e.g., construction of multiple high-speed roadway lanes, highway projects that cut through

communities, etc.), disrupts access, causes displacement, and causes safety and health hazards.

An example of the Burdens evaluation is provided in Figure 18. Additional information is provided in Appendix B.

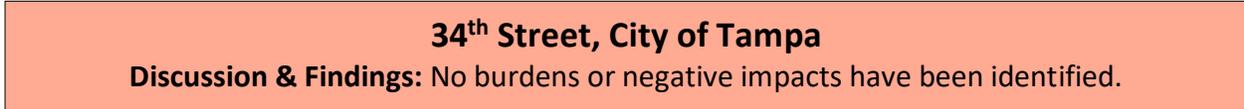


Figure 18. Burdens evaluation

8.3.2 Advanced Methods

Answer the following question:	
<ul style="list-style-type: none"> Does the project increase travel time, emissions, or noise level? Yes/No 	<p>No</p> <p>Yes</p>

Method A:

- Use a travel demand model to compare travel time before and after the project
- Demonstrate any cumulative increase in travel time to and from the project location.

Method B:

- Estimate emissions density (e.g., estimate emissions distribution index by pollution type) and VMT density (e.g., VMT per square kilometer of developed land within 1,000 feet of major roadways) before and after the project.
- Demonstrate any cumulative increase in emissions around the project location.

Method C:

- Estimate transportation noise level before and after the project (e.g., FHWA transportation noise model).
- Demonstrate any cumulative increase in noise level around the project location.

9. Complementary Procedures

This chapter identifies complementary procedures for evaluating projects using the equity scorecard tool. These procedures include public involvement, GIS, and methods for measuring the distributional effects of projects selected using the tool.

9.1 Public Involvement

Public involvement is a necessary part of the equity scorecard project evaluation process. Projects selected without engaging COCs in the prioritization exercise could have limited benefits for those communities, regardless of level, depth, or type of evaluation. Public involvement can validate scorecard results and confirm that selected projects:

- Enhance the transportation experience of those communities,
- Improve access to opportunity and healthy, safe, and affordable connections to all destinations, and
- Do not cause adverse impacts or create barriers.

It is recommended to employ targeted public involvement techniques and get input from affected COCs at each key point in the decision-making process:

- Identifying needs
- Evaluating project alternatives
- Selecting and prioritizing projects for funding

It is important to engage COCs and their representatives before and after identifying beneficial projects for their areas. Community representatives could include human services agencies, advocacy groups, non-profit organizations, public health departments, jurisdictional partners, and many others. These diverse groups could bring together different perspectives to inform the project evaluation and selection process. Building a database of organizations that represent COCs can facilitate the invitation process.

Several techniques could be used by agencies to engage COCs during the project selection process. During public involvement activities, it is important to identify and make special accommodations for persons with disabilities, persons requiring translation services, or persons with other needs. Some useful public involvement techniques include:

- Holding a workshop to help COCs identify their priorities.
- Forming a transportation equity advisory committee or equity working group with experts to identify, evaluate, and select beneficial projects.
- Conducting focus groups or hosting open houses at frequently used community gathering areas, such as a community center, or other locations that are easily accessible by COCs.

- Creating an online tool to increase opportunities for COCs to provide suggestions and feedback related to candidate projects.
- Organizing site visits with the community to tour project sites and identify/confirm the potential impacts of projects.

NOTE: This list is not comprehensive or in order of importance. To ensure effective public involvement, the agency should explore additional techniques beyond those suggested here. Additionally, a combination of techniques could be adopted by agencies using the scorecard tool.

NOTE: Projects that receive high scores using the scorecard tool, but are not supported by COCs near the projects should not be prioritized.

9.2 GIS Analysis

GIS is needed to implement the equity scorecard tool for several reasons:

- It enables agencies to spatially identify areas with high concentrations of COCs and to locate projects geographically;
- It is useful when assessing project coverage and can assist in measuring variables with spatial components;
- It can help agencies communicate results to stakeholders and the public.

Simple GIS procedures are recommended to facilitate the communication process. While using GIS, agencies should ensure that the GIS data is accurate and up-to-date.

The buffer function is suggested during the equity scorecard analysis. Buffer polygons can be placed around projects to measure the proximity of transportation infrastructure, land uses, and other features near projects and COCs. The proximity analysis is useful when evaluating benefits and burdens. For example, an active transportation, safety, or complete streets project that serves COCs and is near various destinations, such as jobs, health care, or community services, is likely to benefit the community. On the other hand, projects in close proximity to COCs that focus on road widening and/or result in increased vehicular speeds can be harmful to those communities.

Various buffer sizes could be selected to evaluate projects depending on the project type, context, mode being evaluated (walking, biking, other), and COCs being served by the project. The end goal should be kept in mind while choosing the buffer size and the rationale for selecting specific buffer sizes should be documented. An illustration of how a buffer can be created around a project is available in Figure 19 using the 34th Street project as an example (see Appendix B for the complete 34th Street project evaluation).

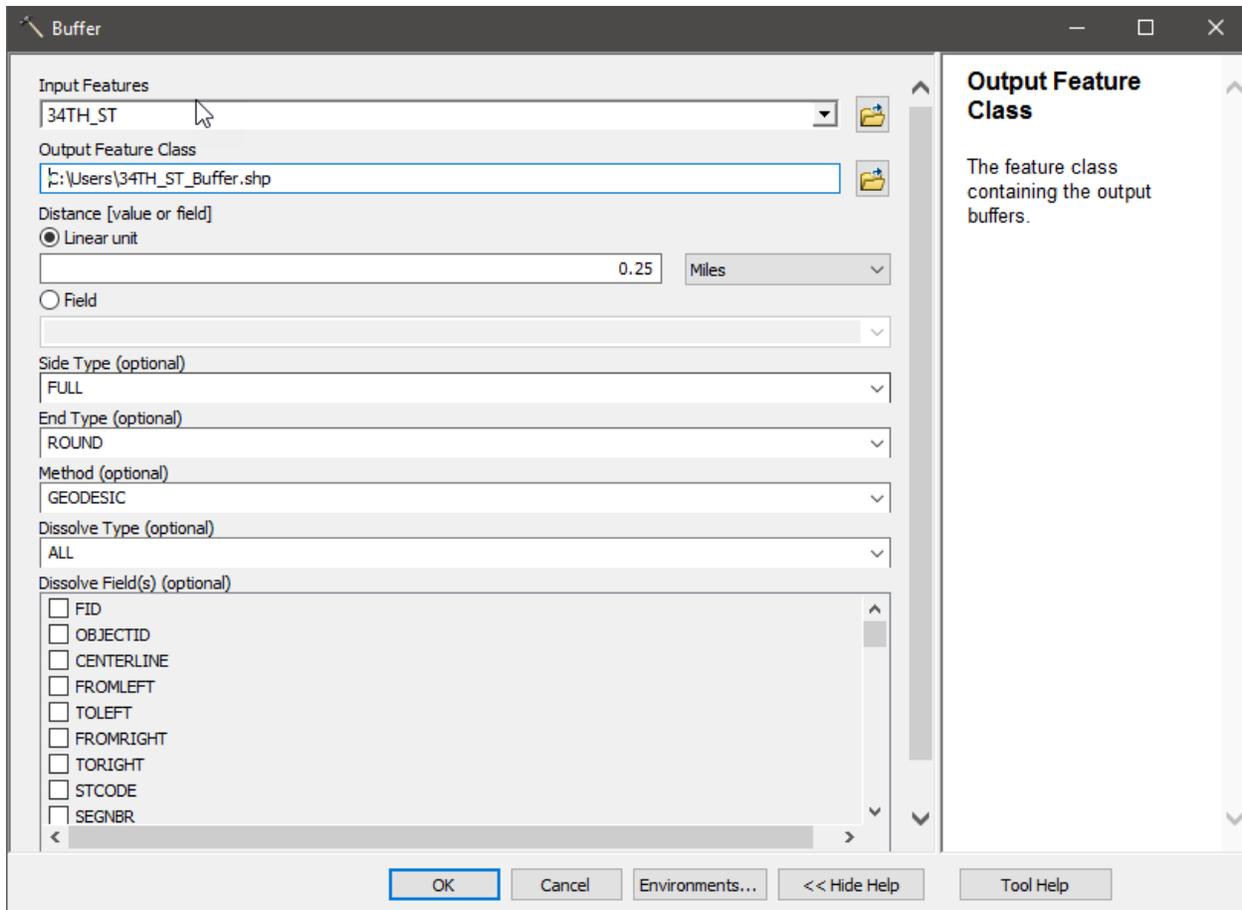


Figure 19. Example of creating a buffer around a project

9.3 Distributional Equity Approaches

After selecting individual projects for funding, agencies should consider distributional equity and evaluate their entire systems, programs, or set of projects to ensure that total investments are fair and serving COCs. The most commonly used evaluation method for distributional equity is a comparison of total funding for COCs and non-COCs. Other approaches described in Section 9.3.1 through Section 9.3.3 may also be used to evaluate distributional equity of total investments.

9.3.1 Population Use-Based Approach

The population use-based approach is used to ensure that COCs are receiving a similar or greater share of investments relative to their share of the total population or total trips. For example, the evaluation identifies the distribution of travel time and distance savings resulting from the proposed transportation projects based on demographic data and mode usage statics. A simple example of this evaluation is shown in Table 19.

Table 19. Example of Population Use-Based Assessment

Fund Committed	% of Funds	% of Population	
\$ 258,381,055	56.0%	32.3%	COCs
\$ 203,091,404	44.0%	67.7%	Non-COCs
\$ 461,472,459	100.0%		

Source: Adapted from CRCOG, 2017

9.3.2 Disparate Impact Analysis

The disparate impact analysis is another assessment of fairness in the distribution of total funding. Agencies evaluate the distribution of total investment in COCs and non-COCs using total funding in each area and then estimate funding per capita. The per capita investment in COCs is then compared to per capita investment in non-COCs and often stratified by mode, types, and categories. An example of the evaluation and results for Forward Pinellas in Pinellas County, Florida, is shown in Figure 20.

	EJ Areas	Non-EJ Areas	Total
Population	370,328	546,214	916,542
Percent of Population	40.4%	59.6%	100%
Committed Highways (2015-2019)	\$615,670,000	\$709,900,000	\$1,325,570,000
Per Capita	\$1,662	\$1,300	\$1,446
Mileage	12.7	23.2	35.9
Cost Feasible Highways (2020-2040)	\$966,250,668	\$614,695,962	\$1,580,946,630
Per Capita	\$2,609	\$1,125	\$1,725
Mileage	24.6	12.3	36.9
Cost Feasible "Core" Transit Plan (2020-2040)	\$969,449,785	\$1,370,089,747	\$2,339,539,532
Per Capita	\$2,618	\$2,508	\$2,553
Mileage	196	277	473
Cost Feasible "Coverage" Transit Plan (2020-2040)	\$1,029,232,056	\$1,310,307,476	\$2,339,539,532
Per Capita	\$2,779	\$2,397	\$2,553

Figure 20. Example of disparate impact analysis

Source: Forward Pinellas, 2014

9.3.3 GIS Mapping

Lastly, GIS could be used to spatially visualize and assess the distribution of projects. This mapping process ensures that the number or proportion of projects serving COCs is similar or close to the number or proportion of projects serving non-COCs. This analysis is often stratified by project types or modes (see Figure 21). After selecting projects for funding using the equity scorecard tool, agencies could map those projects and overlay them on top of all other projects they plan to fund during the same period. One limitation of this approach is that not all projects, such as projects related to transit operations and maintenance, are mappable. Non-mappable projects could be of significance to COCs, therefore other evaluation methods should be considered for these project types.

Santa Clara County: Healthy and Safe Communities Projects

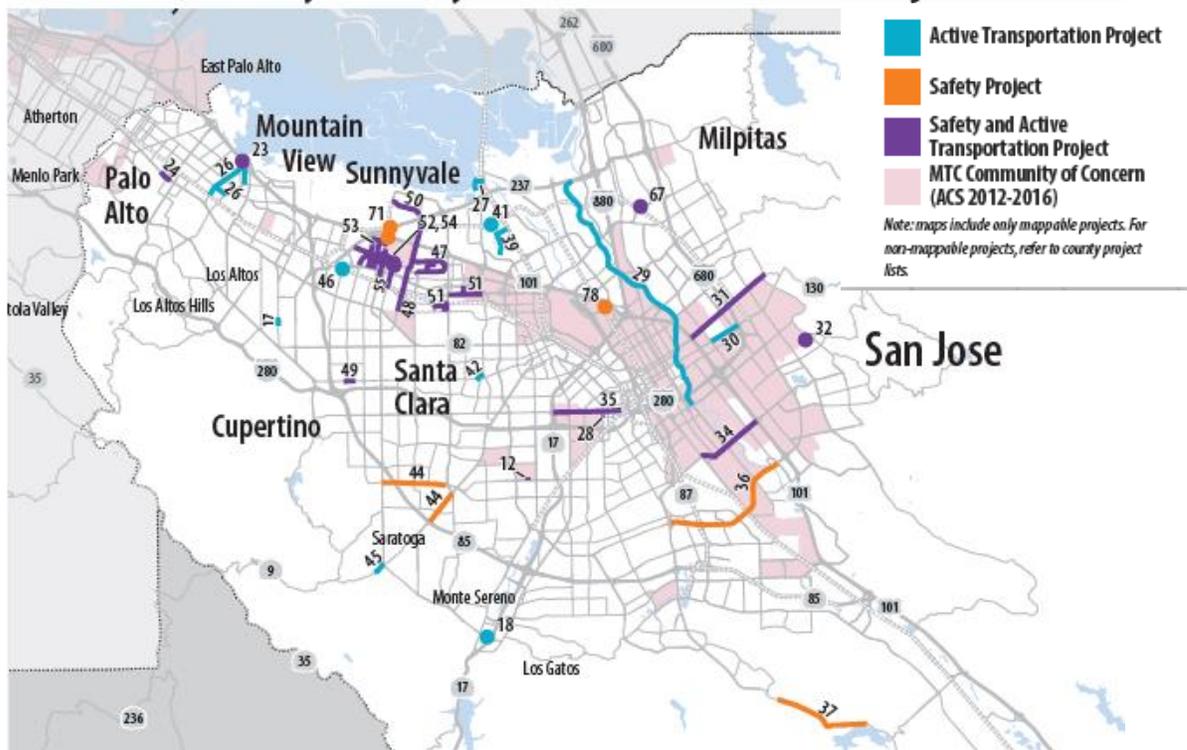


Figure 21. Active transportation and safety project locations relative to COCs

Source: MTC and ABAG, 2018 TIP Investment Analysis

10. Other Considerations

This section addresses a few additional considerations relative to use of the tool in project evaluation. First, it is important to use a suitable buffer to conduct the proximity-based components of the evaluation. This buffer distance may vary based on characteristics of the population. Although a ¼ mile buffer for walking and 1 mile for cycling may be appropriate in most instances, these distances may be too far for communities with a high proportion of elderly or persons with disabilities.

Second, the tool can be adapted to best align with regional and community needs. Agencies can skip or modify certain criteria if they are not relevant or the agency lacks adequate resources to conduct the analysis for that criterion. Consistency is necessary when skipping or modifying criteria to ensure comparable results and limit the potential for error during project prioritization. See Chapter 2 under **Review the Scorecard** and **Step 2: Select Scoring System and Methods** and Appendix C for more information.

Third, although the user guide provides a variety of potential assessment methods, agencies may have other more refined methods and are encouraged to use these methods, where available. The methods suggested in this guide may be modified to better correspond with existing agency methods. Keep in mind that the scorecard supplements and does not replace existing project screening or prioritization methods.

Finally, documentation is necessary if the criteria or evaluation methods are modified. When documenting modifications to the criteria, be sure to specify which criteria were skipped or modified and provide justification for the changes. Also document which methods and tools were used during the evaluation and how these methods and tools may impact the scores. Maintaining transparency in all aspects of the evaluation will help to build trust between stakeholders and the agency.

Additional Resources

Below are additional resources that can be consulted during the project evaluation process to supplement the methods suggested in this user guide.

[Integrating Equity into MPO Project Prioritization Processes](#) documents methods used by MPOs in project prioritization, with a focus on improving equity and access to opportunity for COCs (Williams et al., 2019).

[Evaluating the Distributional Effects of Regional Transportation Plans and Projects](#) provides additional guidance to MPOs on how to evaluate distributional equity in regional plans and projects (Williams et al., 2017)

[The Guidebook for Measuring Multimodal Network Connectivity](#) is a guide for transportation planners and analysts on the application of analysis methods and measures to support transportation planning and programming decisions. It describes a five-step analysis process and numerous methods and measures to support a variety of planning decisions. It includes references and illustrations of current practices, including materials from five case studies conducted as part of the research process (U.S. Department of Transportation Federal Highway Administration, 2018)

[All Aboard! Making Equity and Inclusion Central to Federal Transportation Policy](#) provides a framework of principles, describes the work and ideas of key players, and captures the important policy solutions that should be included in the upcoming federal authorization legislation (PolicyLink, 2009).

[Pursuing Equity in Pedestrian and Bicycle Planning](#) provides an overview of transportation equity, nonmotorized transportation options for traditionally underserved populations, and strategies for improving equity for pedestrians and bicyclists (United States Department of Transportation Federal Highway Administration, 2016).

[Planning with Diverse Communities](#) offers the information and tools planners need to engage people of color in planning processes and improve quality of life for all in ethnically and racially diverse communities. Chapters focus on frameworks and approaches to better engage people of color, including immigrants, in planning processes, and on tools and strategies to improve economic opportunity, transportation access, housing options, health and safety, and placemaking in diverse communities (Garcia et al., 2019).

[Those Who Need it Most: Maximizing Transit Accessibility and Removing Barriers to Employment in Areas of Concentrated Poverty](#) assesses the transportation assets and challenges faced by residents of Areas of Concentrated Poverty (ACPs), paying special attention to ACP50s—ACPs in which people of color comprise more than 50% of the population (Guthrie et al., 2019).

References

- American Association of State Highway and Transportation Officials (AASHTO). (2016). AASHTO practitioner's handbook: Assessing indirect effects and cumulative impacts under NEPA. Retrieved from <https://environment.transportation.org/pdf/programs/ph12-2.pdf>
- Atlanta Regional Commission (ARC). (2017). The ARC TIP Project Evaluation Framework. "The Project Evaluation Cookbook". Retrieved on 09/12/2019 from https://documents.atlantaregional.com/transportation/projsolicitation/2017/project_eval_documentation.pdf
- Bureau of Transportation Statistics. (2018). Chapter 6 - Household Spending on Transportation. Transportation Economic Trends. Washington, D.C.: United States Department of Transportation.
- City of Tampa. Retrieved on 12/17/2019 from <http://city-tampa.opendata.arcgis.com/datasets/park-and-recreation-areas>
- Delaware Valley Regional Planning Commission (DVRPC). (2018b). Philadelphia crash analysis standards & recommendations. Retrieved on 09/09/2019 from <https://www.dvrpc.org/Reports/17068.pdf>
- Environmental Protection Agency. (2016). Technical guidance for assessing environmental justice in regulatory analysis. Retrieved from https://www.epa.gov/sites/production/files/2016-06/documents/ejtg_5_6_16_v5.1.pdf
- Ewing, R., G. Meakins, S. Hamidi, and A. Nelson. 2014. "Relationship between Urban Sprawl and Physical Activity, Obesity, and Morbidity – Update and Refinement." *Health Place* 26: 118–126. doi:10.1016/j.healthplace.2013.12.008.
- Forward Pinellas. (2014). 2040 Long Range Plan, Retrieved on 11/28/2018 from <http://forwardpinellas.org/wp-content/uploads/2016/08/2040-LRTP.pdf>
- Garcia, I., Garfinkel-Castro, A., & Pfeiffer, D. (2019). Planning with diverse communities. Retrieved from <https://www.planning.org/publications/report/9165143/>
- Guthrie, A., Fan, Y., Crabtree, S., & Burga, F. (2019). Those who need it most: Maximizing transit accessibility and removing barriers to employment in areas of concentrated poverty. Retrieved from <http://www.cts.umn.edu/Publications/ResearchReports/reportdetail.html?id=2768>
- Hagen, L. A. V. (2011). Safe routes to New Jersey's disadvantaged urban schools. Retrieved on 09/09/2019 from http://www.saferoutesnj.org/wp-content/uploads/2011/01/Walk-21_VonHagen_Urban_SRTS.pdf
- Harris, D. How Far Do Americans Drive to Work on Average? Retrieved on 01/14/2020 from <https://itstillruns.com/far-americans-drive-work-average-7446397.html>
- Hillsborough MPO. Crash Data. <https://doi.org/10.21949/1502599> Capitol Region Council of Governments (CRCOG). (2017). Equity Assessment for FFY 2018-2021 Transportation Improvement Program. Retrieved on

10/31/2018 from <http://crcog.org/wp-content/uploads/2017/06/TIP-Equity-Assessment-FY2018-2021-Final.pdf>

Kramer, A. (2018). The unaffordable city: Housing and transit in North American cities. *Cities*, 83, 1–10. <https://doi.org/10.1016/j.cities.2018.05.013>

Litman, T. (2016). Evaluating accessibility for transportation planning: Measuring people’s ability to reach desired goods and activities. Victoria Transport Policy Institute. Retrieved from <https://www.vtpi.org/access.pdf>

Metropolitan Transportation Commission (MTC) and Association of Bay Area of Governments (ABAG). (2018). 2019 TIP Investment Analysis. Retrieved on 07/01/2019 from https://mtc.ca.gov/sites/default/files/Investment_Analysis_Final_2019_TIP.pdf

Nabors, D., R. Schneider, D. Leven, K. Lieberman, K., and C. Mitchell. (2008). Pedestrian Safety Guide for Transit Agencies. FHWA-SA-07-017. Retrieved from https://safety.fhwa.dot.gov/ped_bike/ped_transit/ped_transguide/index.cfm#toc

Peacock-McLaughlin, C., E. Largo-Wight, P. Wlyudka, T. Johnson and J. Merten (2018) The built environment, transportation policy, and population health: a comparison of two cities, *Urban Research & Practice*, 11:3, 193-199, DOI:10.1080/17535069.2017.1322134.

PolicyLink. (2009). All aboard! Making equity and inclusion central to federal transportation policy. Retrieved from <https://www.policylink.org/resources-tools/all-aboard-making-equity-and-inclusion-central-to-federal-transportation-policy>

San Diego Association of Governments (SANDAG). (2019). San Diego forward: the 2019 federal regional plan. Appendix S. Retrieved on 03/18/2020 from https://sdforward.com/docs/default-source/2019federalrtp/draftfinal/app-s---monitoring-performance.pdf?sfvrsn=8a47ff65_2

United States Census Bureau Longitudinal Employer-Household Dynamics (LEHD). Origin-Destination Employment Statistics (LODES). Retrieved on 12/17/2019 from <https://lehd.ces.census.gov/data/>

United States Department of Agriculture (USDA) Economic Research Service. Retrieved on 12/17/2019 from <https://www.ers.usda.gov/data-products/food-access-research-atlas/.aspx>

United States Department of Homeland Security (Homeland Infrastructure Foundation-Level Data (HIFLD)). Retrieved on 12/17/2019 from <https://hifld-geoplatform.opendata.arcgis.com/>

United States Department of Housing and Urban Development. Retrieved on 12/17/2019 from <http://hudgis-hud.opendata.arcgis.com/>

United States Department of Transportation Federal Highway Administration. (2018). Guidebook for measuring multimodal network connectivity. Retrieved from https://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/multimodal_connectivity/

- United States Department of Transportation Federal Highway Administration. (2016). Pursuing equity in pedestrian and bicycle planning. Retrieved from https://www.fhwa.dot.gov/environment/bicycle_pedestrian/resources/equity_paper/
- Williams, K., and A. Golub. (2017). Evaluating the Distributional Effects of Regional Transportation Plans and Projects. National Institute for Transportation and Communities (NITC).
- Williams, K., J. Kramer, Y. Keita, L. Deba Enomah, and T. Boyd. (2019). Integrating Equity into MPO Project Prioritization. Center for Transportation Equity, Decisions, and Dollars, CTEDD Project No. 018-03.
- Yang, Y., & A. Diez-Roux. (2013). Walking distance by trip purpose and population subgroups. Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3377942/#R10>

Appendix A

Variables to Identify Communities of Concern

Table A 1. Example Variables to Identify Communities of Concern

Equity Dimension	Data Source	Metric	Comments
Low-Income Communities	U.S. Census Bureau and American Community Survey (ACS). Households Living In Poverty <ul style="list-style-type: none"> B17017 - POVERTY STATUS IN THE PAST 12 MONTHS BY HOUSEHOLD TYPE BY AGE OF HOUSEHOLDER Link to Table Description	Block groups with percentage of households living at or below 185% of poverty line	185% of the poverty line is used to include a broader population of economically disadvantaged persons. At or below the poverty line includes only the very poor.
Zero-Vehicle Households	U.S. Census Bureau and American Community Survey (ACS). Households with Zero Vehicles Available <ul style="list-style-type: none"> B25044 - TENURE BY VEHICLES AVAILABLE Link to Table Description	Block groups with percentage of zero vehicle households more than 1 standard deviation above the countywide average (average = 2%).	
Minorities	U.S. Census Bureau and American Community Survey (ACS). Minority Population - African American, Hispanic, Asian, American Indian, and or Alaskan Native. <ul style="list-style-type: none"> B03002 - HISPANIC OR LATINO ORIGIN BY RACE Link to Table Description	Block groups with percentage of minority population more than 1 standard deviation above the countywide average (average = 46.8%).	Census information designates table as only Hispanic or Latino origin by race, but includes all other races and ethnicities.
Elderly	U.S. Census Bureau and American Community Survey (ACS). Over 65 <ul style="list-style-type: none"> B01001 - SEX BY AGE Link to Table Description	Block groups with percentage of population ≥65 years old more than 1 standard deviation above the countywide average (average = 14.02%).	
Youth	U.S. Census Bureau and American Community Survey (ACS). Under 18 <ul style="list-style-type: none"> B01001 - SEX BY AGE Link to Table Description	Block groups with percentage of population <18 years old more than 1 standard deviation above the countywide average (average = 21.7%).	
Limited English Proficiency (LEP)	U.S. Census Bureau and American Community Survey (ACS). Limited English Proficiency	Block groups with percentage of LEP population more than 1 standard deviation above the	

	<ul style="list-style-type: none"> B16002 - HOUSEHOLD LANGUAGE BY HOUSEHOLD LIMITED ENGLISH SPEAKING STATUS <p>Link to Table Description</p>	countywide average (Average = 5.9%).	
Disability	<p>U.S. Census Bureau and American Community Survey (ACS).</p> <ul style="list-style-type: none"> C23023 - SEX BY DISABILITY STATUS BY FULL-TIME WORK STATUS IN THE PAST 12 MONTHS FOR THE POPULATION 16 TO 64 YEARS <p>Universe: Population 16 to 64 years</p> <p>Link to Table Description</p>	Block groups with percentage of disabled full-time workers in past 12 months more than 1 standard deviation above the countywide average (average = 10.8%).	
Female Head of household or single-parent households *	<p>U.S. Census Bureau and American Community Survey (ACS).</p> <ul style="list-style-type: none"> B11003: FAMILY TYPE BY PRESENCE AND AGE OF OWN CHILDREN UNDER 18 YEARS <p>Link to Table Description</p>		
Households receiving food stamps*	<p>U.S. Census Bureau and American Community Survey (ACS).</p> <ul style="list-style-type: none"> B22007: RECEIPT OF FOOD STAMPS/SNAP IN THE PAST 12 MONTHS BY FAMILY TYPE BY NUMBER OF WORKERS IN FAMILY IN THE PAST 12 MONTHS <p>Link to Table Description</p>		
Households in neighborhoods with low to medium home values*	<p>U.S. Census Bureau and American Community Survey (ACS).</p> <ul style="list-style-type: none"> B25076 - LOWER VALUE QUARTILE (DOLLARS) <p>Link to Table Description</p>		
Households where the head has no high school education*	<p>U.S. Census Bureau and American Community Survey (ACS).</p> <ul style="list-style-type: none"> S1501 EDUCATIONAL ATTAINMENT <p>Link to Table Description</p>		
Rent-burdened households *	<p>U.S. Census Bureau and American Community Survey (ACS).</p> <ul style="list-style-type: none"> B25071_001: Rent Burden (MEDIAN GROSS RENT AS A PERCENTAGE OF HOUSEHOLD INCOME) 	Block groups with percentage of households spending more than 50 percent of their household income on housing.	

	Link to Table Description		
Transportation related health distressed populations*	Vary by region and not available for every region.	Areas with moderate or high concentrations of health concerns (asthma, childhood obesity, adult diabetes)	
Communities of Concern	U.S. Census Bureau and American Community Survey (ACS) -All previous data	Block groups that contain 2 or more of the above demographic variables	Use of 2 or more variables identifies concentrations of COCs as areas of potentially greatest need.
*Added group			

Adapted from Williams and Golub, 2017

Appendix B Evaluation Examples

This section includes summaries of the 34th Street and East-West Green Spine Phases 2 and 3 evaluations. Results are shown in Figure B 29 and Figure B 30.

34th Street

The 34th Street project is a 2-mile segment from Columbus Drive to Hillsborough Avenue. It is a 2-lane undivided collector with a speed limit of 30 mph and an average daily traffic volume of 6,000 to 8,000 vehicles per day. Based on safety analyses conducted by the City of Tampa, the project segment was identified as a high fatality segment and was submitted for consideration by the Florida Department of Transportation (FDOT) as part of the Highway Safety Improvement Program (HSIP) off-system funds. Specific improvements include roundabouts, resurfacing and pedestrian ramp improvements, bicycle facilities (bike lanes and shared lane arrows). One of the proposed roundabouts is shown in Figure B 1.

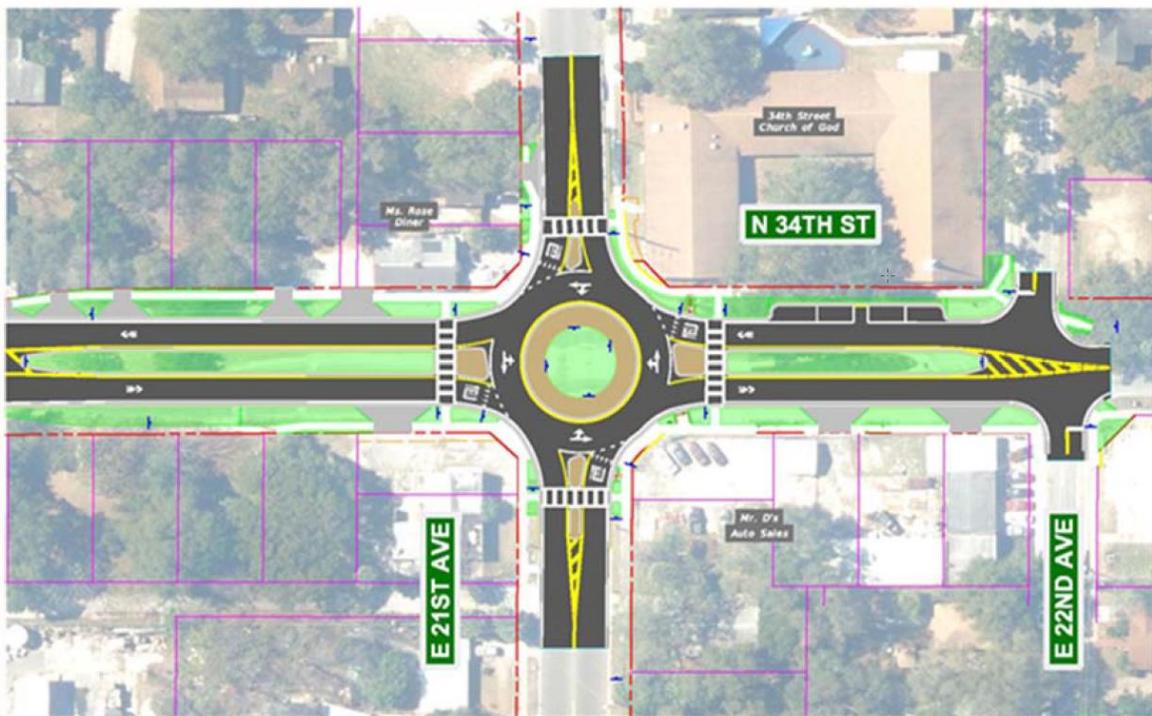


Figure B 1. 34th street project proposed roundabout

- The project is within ¼-mile of COCs. The project corridor, 34th Street between Columbus Drive and Hillsborough Avenue, is in an area with a high concentration of COCs (3 or more variables), as shown in Figure B 2. The project will receive 2 points for each of the criteria that are met.

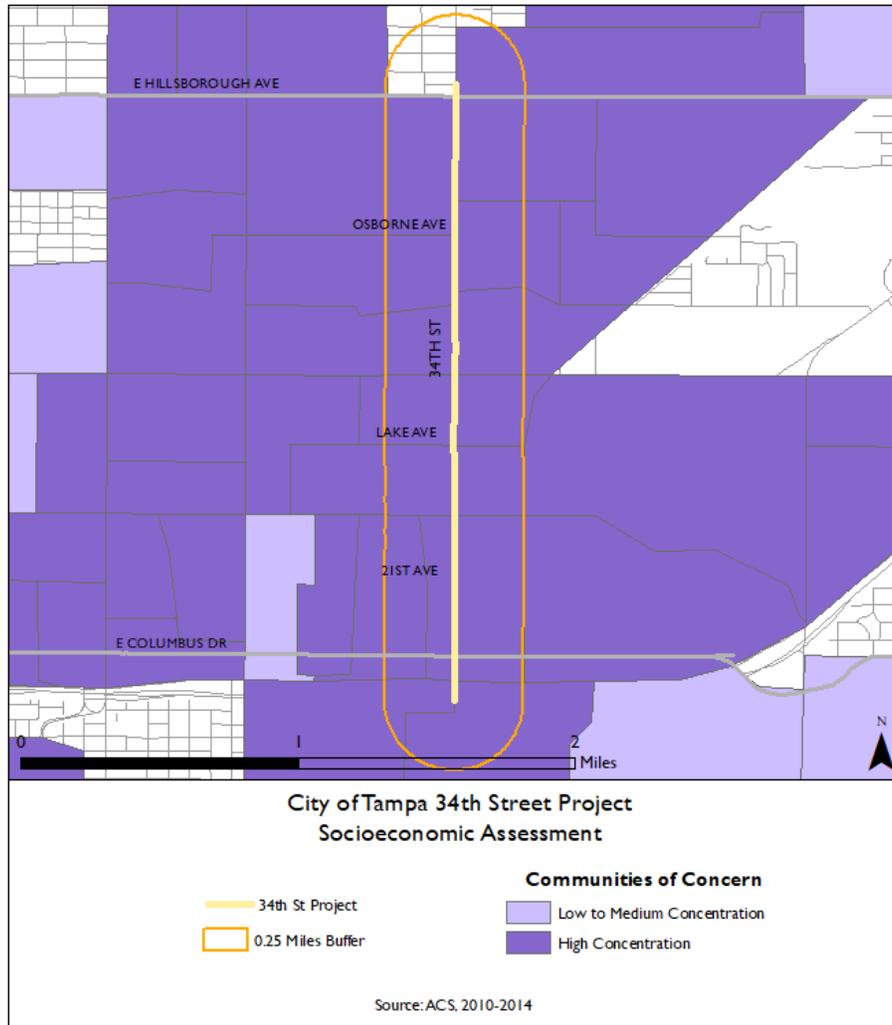


Figure B 2. 34th street project socioeconomic assessment

Access to Opportunity

The data sources used to evaluate the 34th Street project for access to opportunity are listed in Table B 1. The GIS layers for jobs, education, and parks and recreation were also obtained from these sources. The essential destinations layer, created during an equity study by Williams and Golub (2017) using data from the United States Census Bureau Longitudinal Employer-Household Dynamics (LEHD) Origin-Destination Employment Statistics (LODES), is used with the other layers to show the locations of each destination type. The project is then overlaid on each layer separately. A ¼-mile buffer is created to assess the concentration of jobs and essential destinations, and the availability of schools, parks, or recreational areas within a quarter-mile of the project.

- The project improves access to jobs, education, community services, and parks and recreation (see Figure B 3, Figure B 4, and the Mobility evaluation). The project is within a ¼-mile of:

- An area with essential destinations, including community services.
- Several child care centers, public schools, and private schools.

Table B 1. Access to Opportunity Indicators and Data Sources for 34th Street

Factor	Indicator	Data Source
Employment	<ul style="list-style-type: none"> • Essential Destinations 	United States Census Bureau LEHD Origin-Destination Employment Statistics (LODES) https://lehd.ces.census.gov/data/
	<ul style="list-style-type: none"> • Jobs Proximity Index 	U.S. Department of Housing and Urban Development https://hudgis-hud.opendata.arcgis.com/datasets/jobs-proximity-index
Education	<ul style="list-style-type: none"> • Public Schools • Private Schools • Child Care Centers • Colleges and Universities 	U.S. Department of Homeland Security (Homeland Infrastructure Foundation-Level Data (HIFLD)) https://hifld-geoplatform.opendata.arcgis.com/
Community Services and Shopping	<ul style="list-style-type: none"> • Parks and Recreation 	City of Tampa http://city-tampa.opendata.arcgis.com/datasets/park-and-recreation-areas
	<ul style="list-style-type: none"> • Essential Destinations 	United States Census Bureau LEHD Origin-Destination Employment Statistics (LODES) https://lehd.ces.census.gov/data/

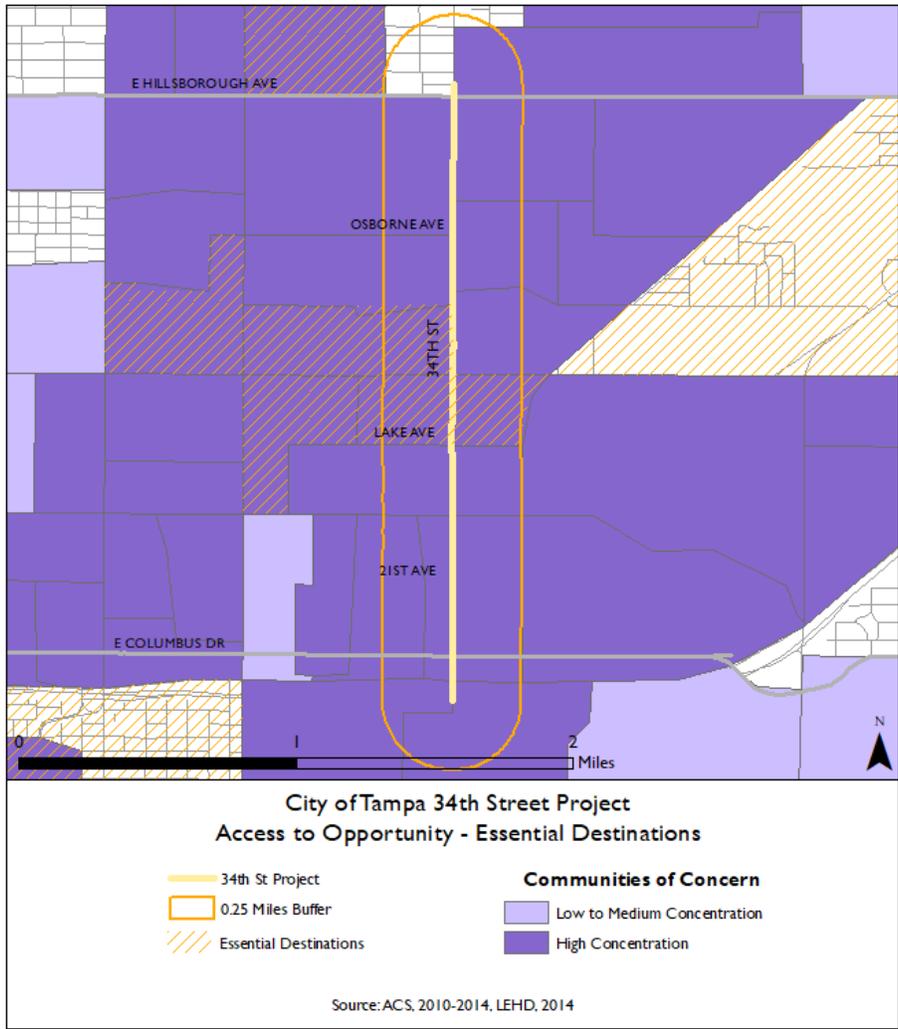


Figure B 3. 34th street project essential destinations

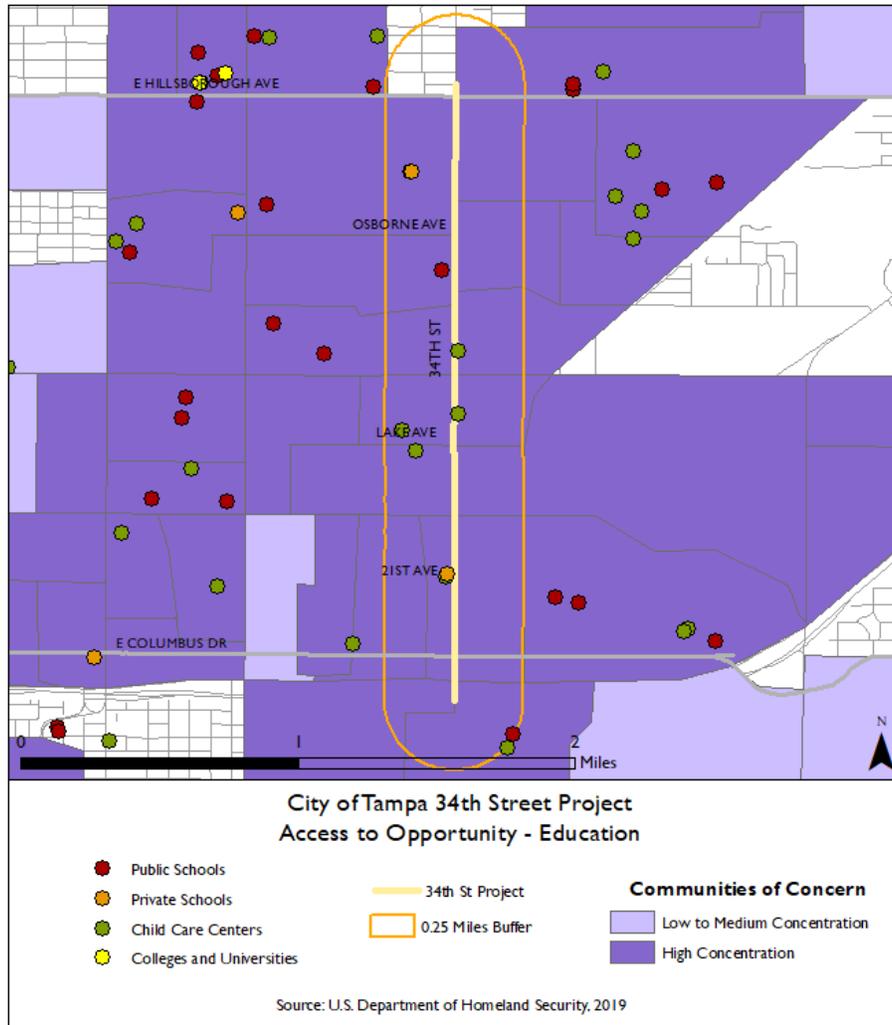


Figure B 4. 34th street project access to education

Health and Environment

Health care and food layers are obtained from the data sources listed in Table B 2. The project is then overlaid on each layer and a ¼-mile buffer is created around the project to evaluate the availability of health care facilities and grocery stores near the project. Data from the U.S. Department of Homeland Security is supplemented with data from Google Earth to identify the locations of primary care doctors and offices, health care centers, dentists, eye doctors, and pharmacies. Food deserts and the percent of the population in food deserts are also mapped. This information was used to assess current access to food conditions before the project and assist in determining how the project could improve access to food.

- The project improves access to health care and food (see Figure B 5 - Figure B 7).
 - GIS mapping shows several health care facilities near the project and one health care facility within a ¼-mile of the project.
 - The project corridor overlays on low access food areas within a ½-mile of the project and is within a ¼-mile of several grocery stores.

The project description is also examined to identify details related to community cohesion, aesthetics, and noise reduction.

- The project addresses aesthetics. The roundabouts have aesthetic qualities and provide more green space.

Table B 2. Health Indicators and Data Sources for 34th Street

Factor	Indicator	Data Source
Health Care	<ul style="list-style-type: none"> • Hospitals • Urgent Care Facilities 	U.S. Department of Homeland Security (Homeland Infrastructure Foundation-Level Data (HIFLD)) https://hifld-geoplatform.opendata.arcgis.com/
	<ul style="list-style-type: none"> • Doctor’s Offices • Health Care Facilities • Primary Care Doctors • Dentists • Eye Doctors • Pharmacies 	Google Earth
Healthy Food	<ul style="list-style-type: none"> • Grocery Stores 	Google Earth
	<ul style="list-style-type: none"> • Low Food Access at Half-Mile • Low Food Access at a Mile • Share of Population Beyond 1/2 Mile from Supermarket • Share of Population Beyond 1 Mile from Supermarket 	United States Department of Agriculture (USDA) Economic Research Service https://www.ers.usda.gov/data-products/food-access-research-atlas/.aspx

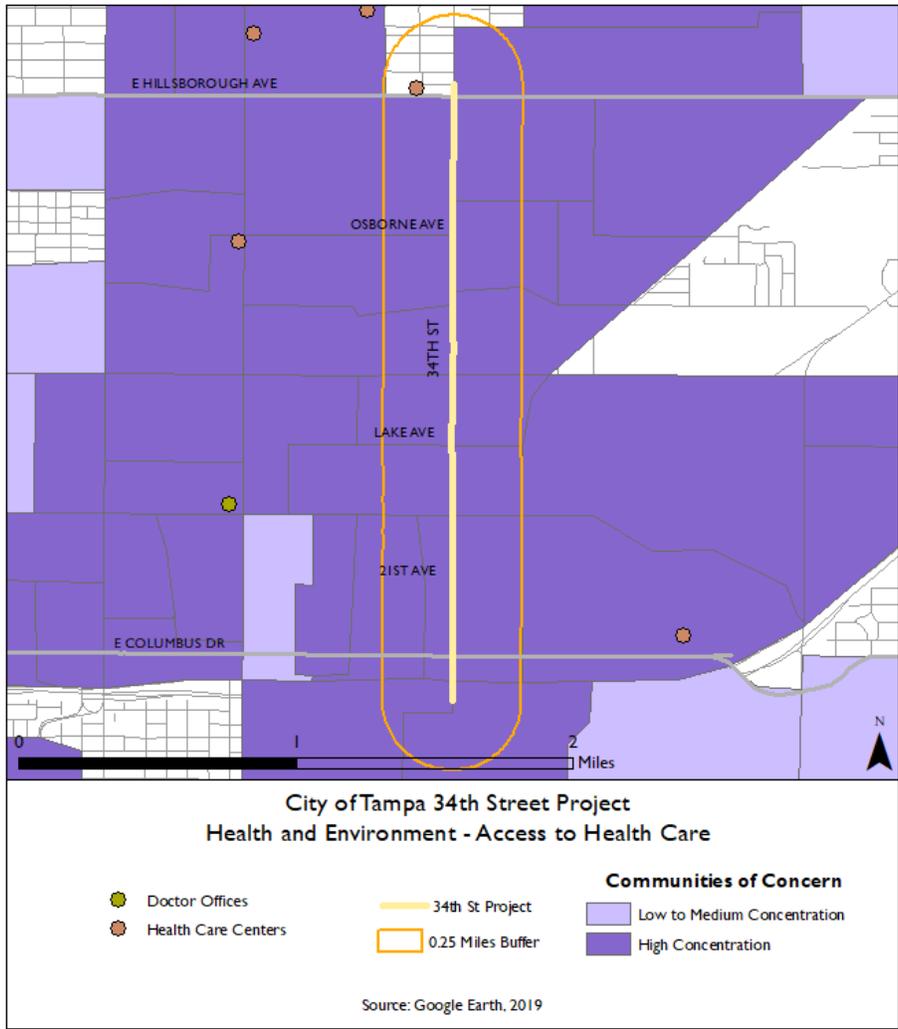


Figure B 5. 34th street project access to health care

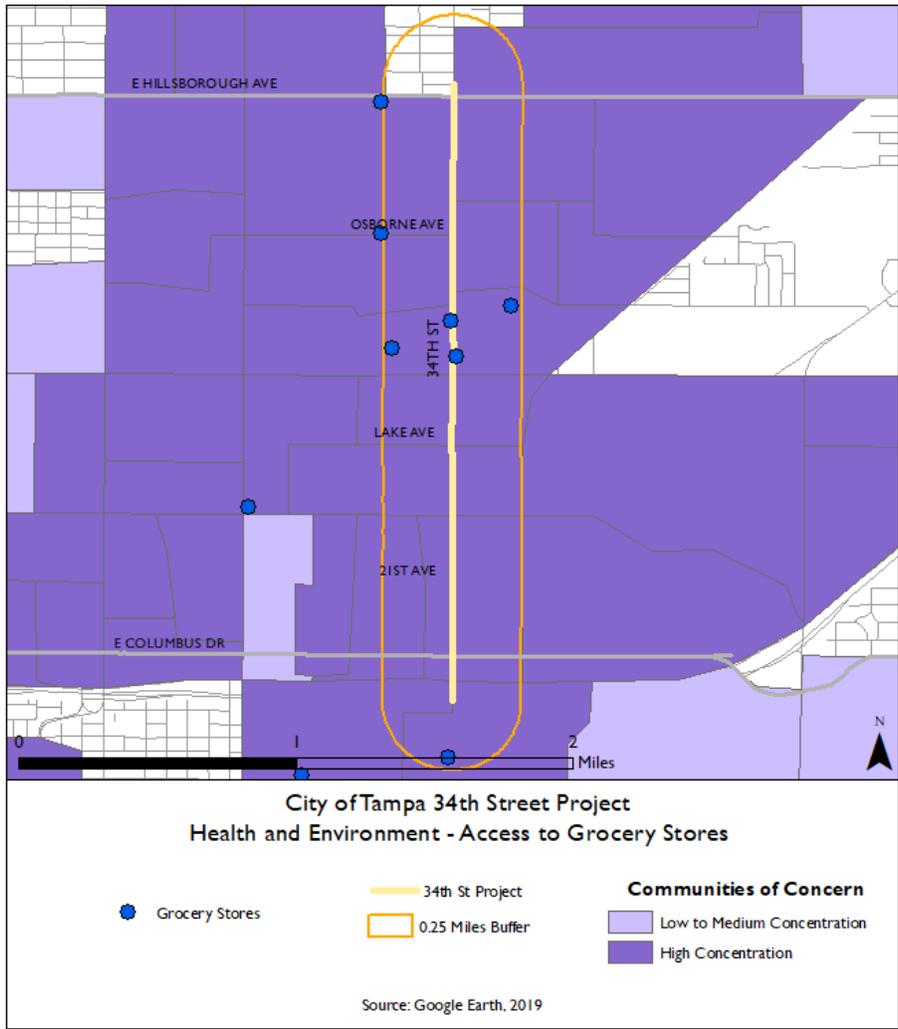


Figure B 6. 34th street project access to grocery stores

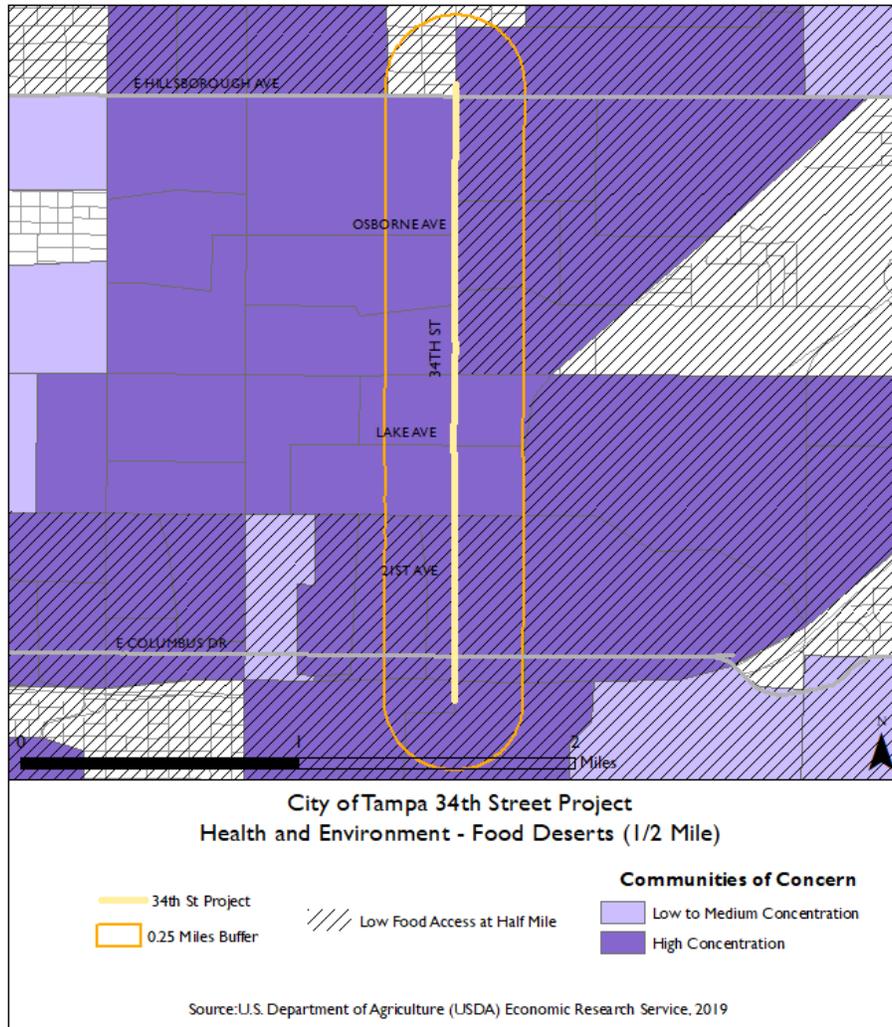


Figure B 7. 34th street project food deserts within one-half mile

Safety and Emergency Evacuation

The project description is evaluated to ensure that the project is a safety project with appropriate countermeasures for pedestrians and bicyclists at high-crash locations and other (non-high crash) locations.

- The project includes safety countermeasures to reduce crashes at high-crash locations and other locations. These countermeasures include roundabouts and road diets, which are designed to improve safety along the project corridor.

The project is also mapped and a ¼-mile buffer is created around the project corridor. Shelters and emergency medical services (EMS) locations (see Table B 3) are overlaid on the project to determine the availability of those facilities within ¼-mile of the project.

- The project improves emergency evacuation. The project is within close proximity to and would benefit mobility relative to a national shelter facility and an EMS station as illustrated in Figure B 8.

Table B 3. Safety and Emergency Evacuation Indicators and Data Sources for 34th Street

Factor	Indicator	Data Source
Emergency Evacuation	Crash data by fatality, severity, and modes	Hillsborough MPO
	National Shelter System Facilities Emergency Medical Service (EMS) Stations	U.S. Department of Homeland Security (Homeland Infrastructure Foundation- Level Data (HIFLD))
	Hurricane Evacuation Routes	https://hifld-geoplatform.opendata.arcgis.com/

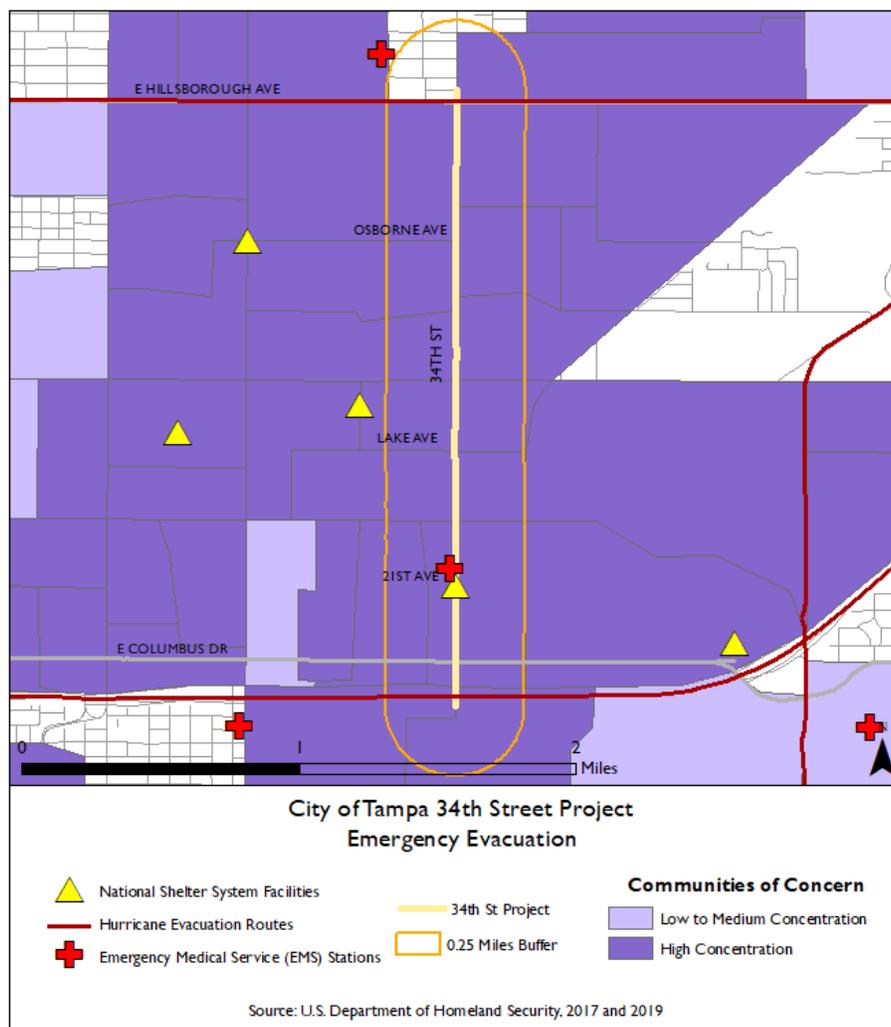


Figure B 8. 34th street project emergency evacuation

Affordability

Data from the sources identified in Table B 4 are used to map affordable housing locations including low-income housing tax credit properties, multifamily properties receiving assistance from the U.S. Department of Housing and Urban Development (HUD), public housing buildings, and housing choice vouchers. The project is overlaid on top of those layers and a ¼-mile buffer is created around the project. This information is used to assess the availability of affordable housing locations within a quarter-mile of the project and the percent of the population with housing vouchers near the project.

- The project improves access to affordable housing. There is at least one multifamily property receiving subsidies or grants from HUD or low-income housing tax credit property near the project (see Figure B 9).

The project description is analyzed to find details related to affordable transportation options. A map of the transportation cost index is generated using data from HUD to show areas with high transportation costs near the project (see Table B 4). A qualitative assessment is conducted to determine how the project will help reduce transportation costs.

- The project spans areas with high transportation costs (see Figure B 10) and improves walking and biking for those areas. Walking and biking are considered affordable transportation choices.

The project is also overlaid on the map of housing and transportation costs percent of income using available national data from HUD (see Table B 4). A ¼-mile buffer is created around the project. Information from the project description, including the project type, are also considered for affordable transportation improvements or additions.

- The project spans areas where housing and transportation costs are between 51 and 75 percent of household income, as illustrated in Figure B 11. The project will improve walking and biking along the project corridor, making these more viable transportation options and potentially decreasing the share of household income consumed by transportation and housing.

Table B 4. Affordability Indicators and Data Sources for 34th Street

Factor	Indicator	Data Source
Housing and Transportation Costs	<ul style="list-style-type: none"> • Location Affordability Index V 3.0 <ul style="list-style-type: none"> ○ Housing and Transportation Costs as a Percent of Income (The household profile of median-income family of size four and two commuters is used) 	U.S. Department of Housing and Urban Development http://hudgis-hud.opendata.arcgis.com/

Housing	<ul style="list-style-type: none"> • Low Income Housing Tax Credit Properties • Multifamily Properties Assisted • Public Housing Buildings • Housing Choice Vouchers by Tract 	U.S. Department of Housing and Urban Development http://hudgis-hud.opendata.arcgis.com/
Transportation	<ul style="list-style-type: none"> • Low Transportation Cost Index 	U.S. Department of Housing and Urban Development http://hudgis-hud.opendata.arcgis.com/

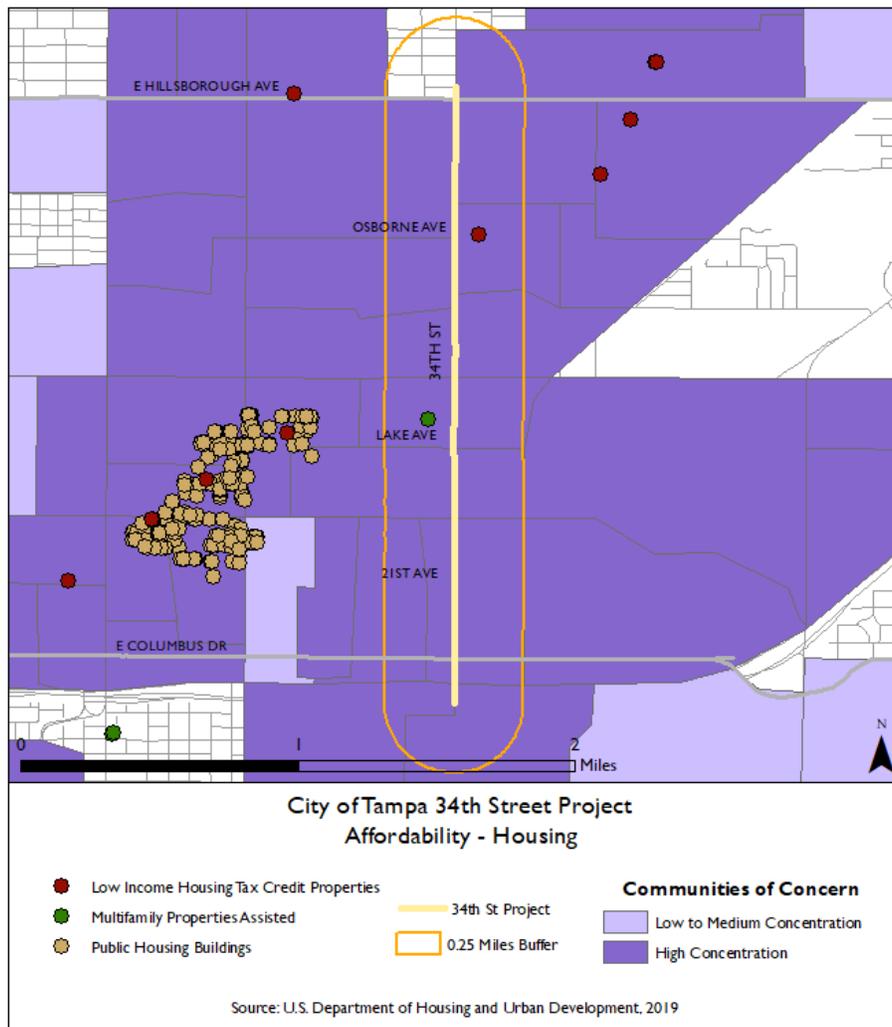


Figure B 9. 34th Street project area affordable housing

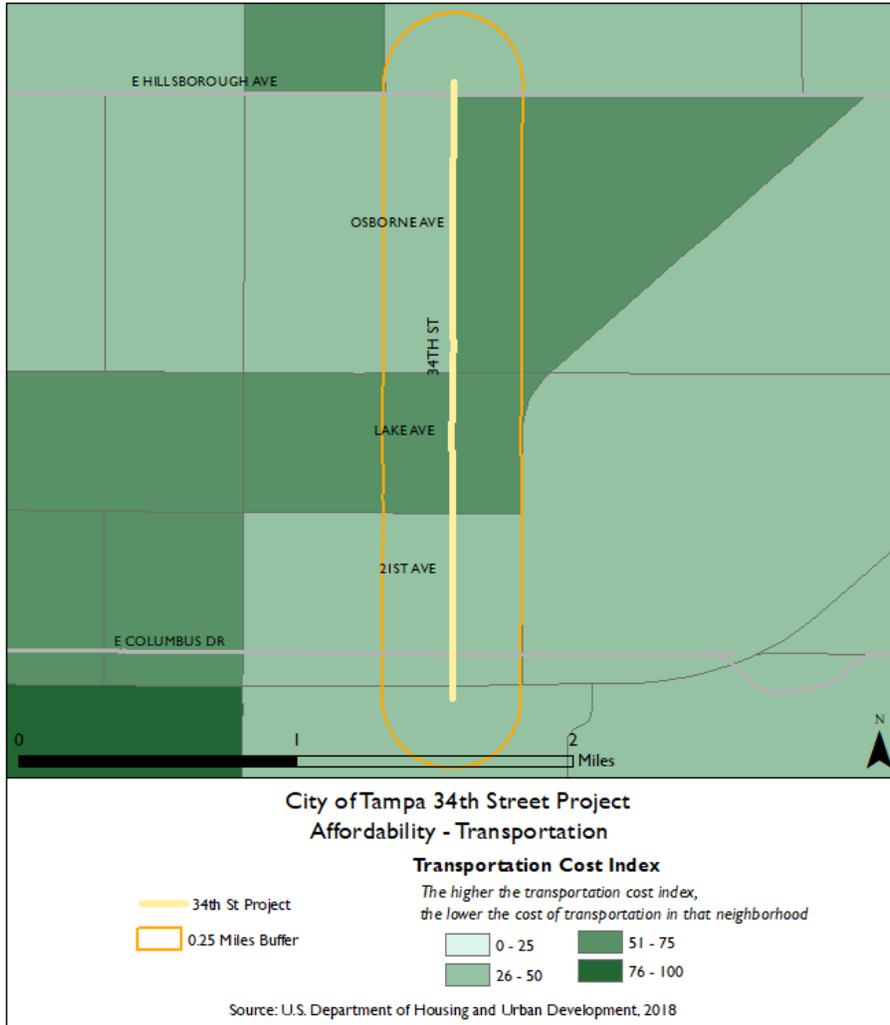


Figure B 10. 34th street project area transportation cost index

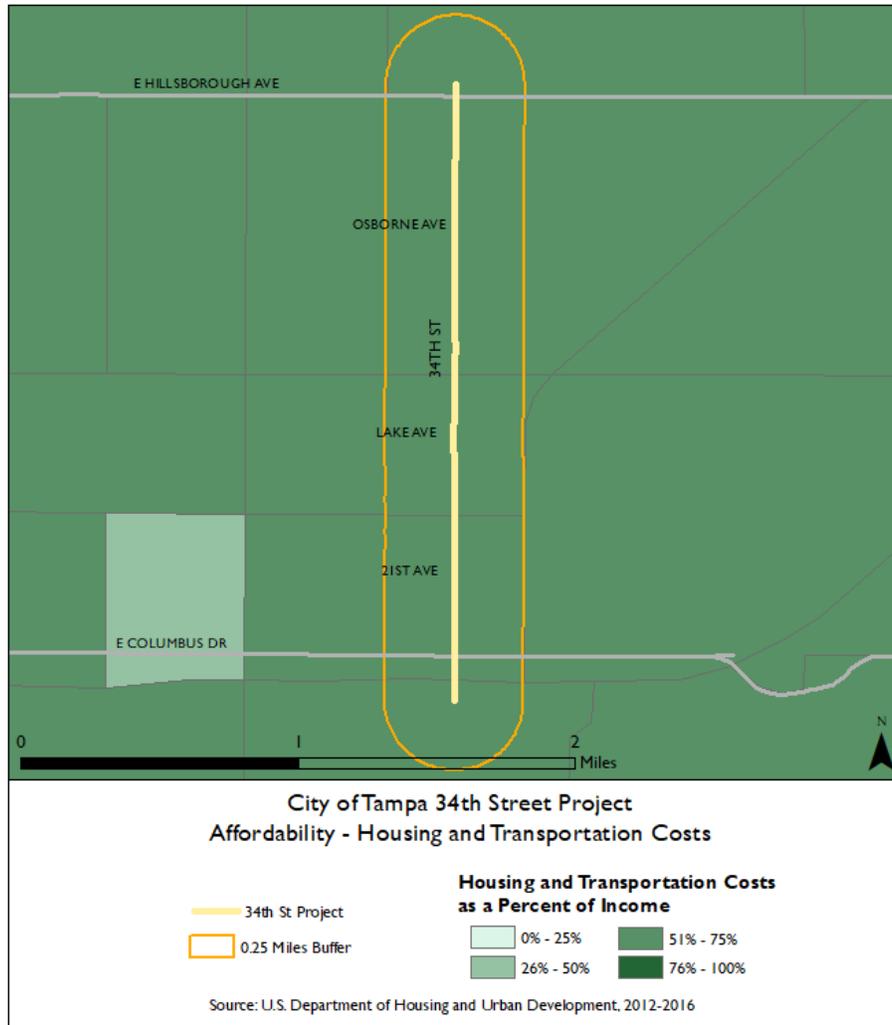


Figure B 11. 34th street project area housing and transportation costs

Mobility

The project details are used to determine if the project includes active transportation improvements or additions.

- The project proposes bicycle facilities, including bike lanes and shared lane arrows. New sidewalks and pedestrian ramps are proposed at roundabouts.
- Transit routes and stops and the project are mapped using data from the Hillsborough County MPO. A ¼-mile buffer is created around the project and is used to evaluate the availability of routes and stops near the project.
- The project improves transit access, including first-mile/last-mile access. A transit route (HART Bus Route 5) is along 34th Street and bicycle and pedestrian improvements are proposed in the vicinity of the transit stops (see Figure B 12).

- Project details are employed to determine if it includes special measures to improve accessibility for persons with disabilities, including correcting existing deficiencies.
- The project improves transit stop accessibility.

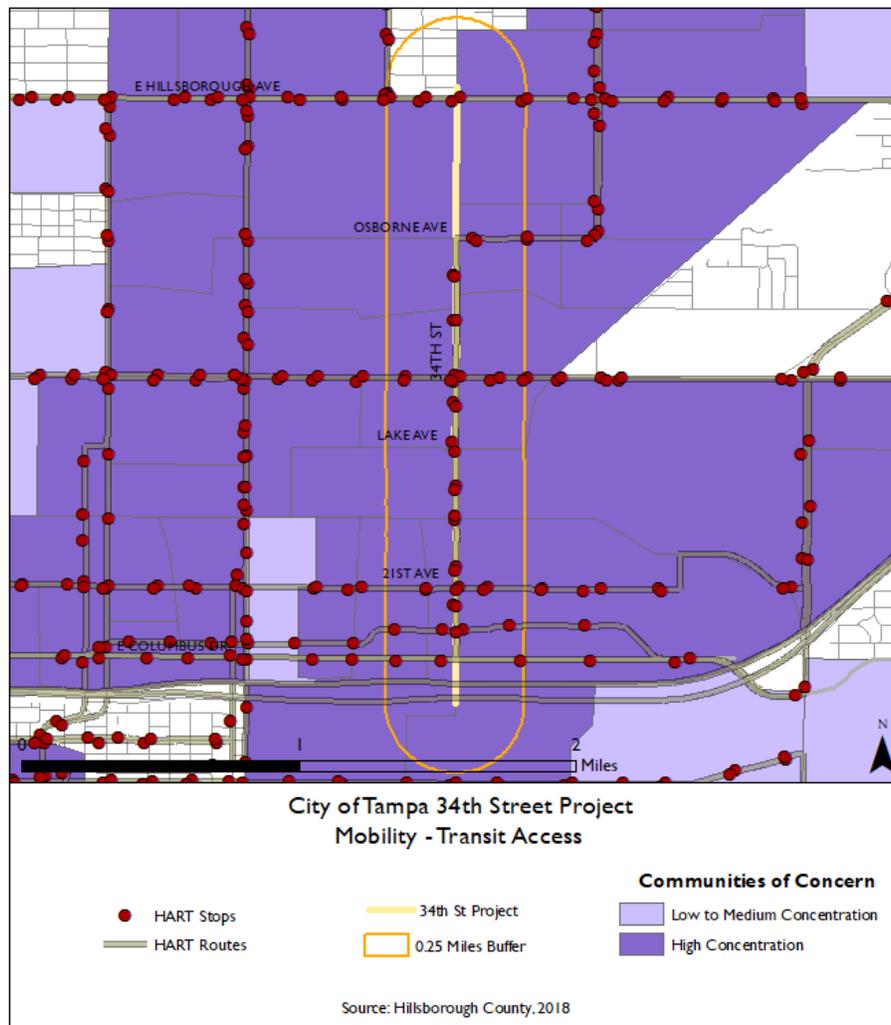


Figure B 12. 34th Street project area transit access

Burdens

The project description and other available information are used to determine if the project has adverse impacts or exacerbates past impacts.

- No burdens or negative impacts have been identified.

East-West Green Spine Phases 2&3

The project consists phases 2 and 3 of an urban trail/cycle track called the East-West Green Spine. As part of the InVision Tampa Center City Plan, this project was conceived to provide pedestrian and bicycle access between North Hyde Park, Downtown, and Ybor City. Additionally, the project aims to provide a safe and accessible bicycle connection to the Tampa Riverwalk and safe connections between neighborhoods. The trail runs along Cass Street, Nuccio Parkway, and 15th Street to connect North Hyde Park from Howard and Armenia Avenues, as well as Tampa Heights, Ragan Park, and Vicente Martinez Ybor to the Hillsborough River. The cycle track begins at Howard Avenue and Cass Street near the Armory. It follows Cass Street into downtown to Nebraska Avenue, then Nuccio Parkway into Ybor City, then 15th Street to Cuscaden Park at 21st Avenue. An overview of the project is shown in Figure B 13. Phases 2 and 3 are considered in beta test; phase 1 is already under construction and connects phase 2 and 3.



Figure B 13. East-West Green Spine project

- For both phases 2 and 3, the project is in an area with a high concentration of COCs (3 or more variables), as shown in Figure B 14.

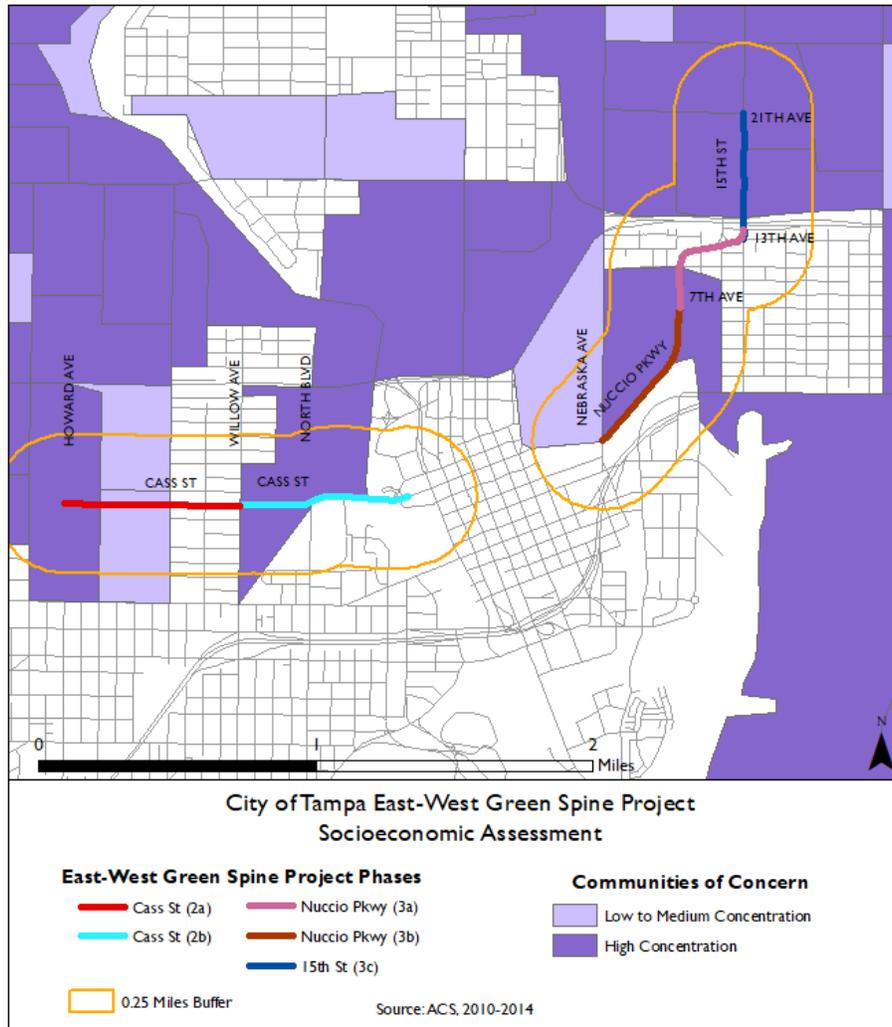


Figure B 14. East-West Green Spine socioeconomic assessment

The data and methods used in the East-West Green Spin project evaluation are the same as those used in the 34th Street project evaluation. Results for phases 2 and 3 are summarized in the following sections.

Access to Opportunity

- The data used for this evaluation is provided in Table B 1. Both phases 2 and 3 of this project improve access to jobs, education, community services, and parks and recreation (see Figure B 15 to Figure B 18 and the Mobility evaluation).
 - The project serves an area with a relatively high jobs proximity index.
 - The project serves an area with essential destinations, including community services.
 - The project corridor is within a ¼-mile of child care centers, a private school, and a college or university.
 - The project corridor is within a ¼-mile of several parks/recreational areas.

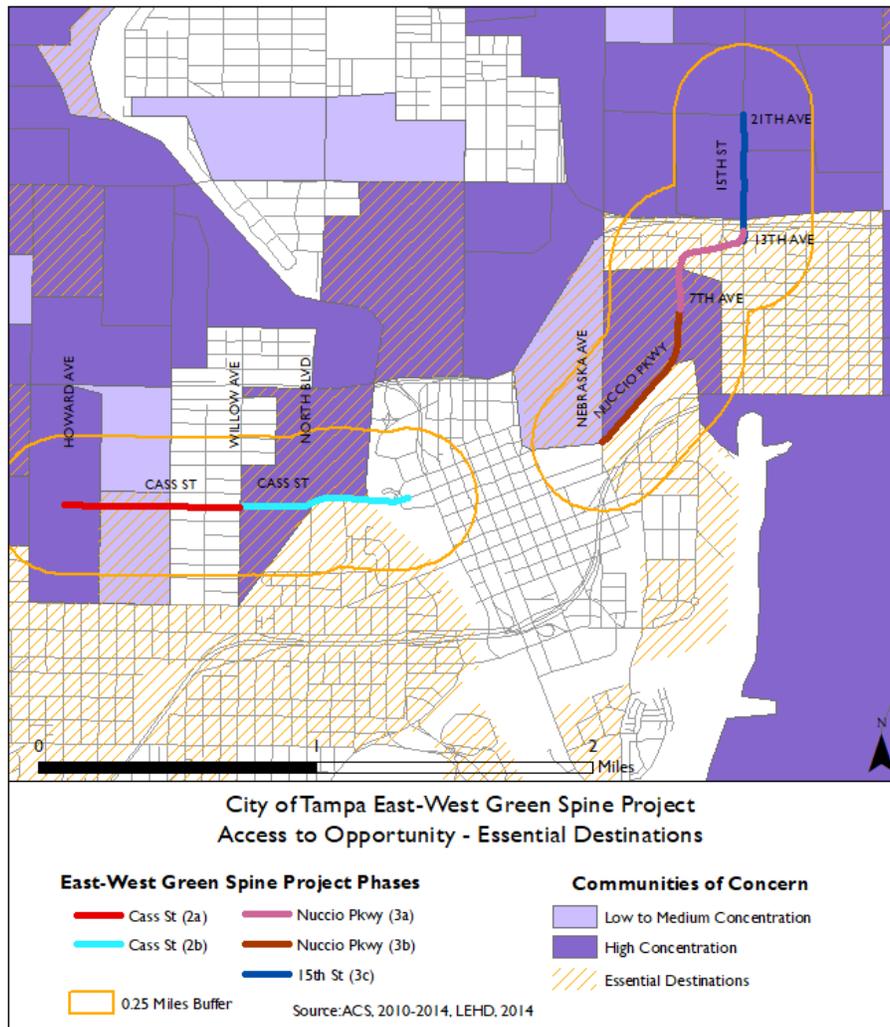


Figure B 15. East-West Green Spine essential destinations

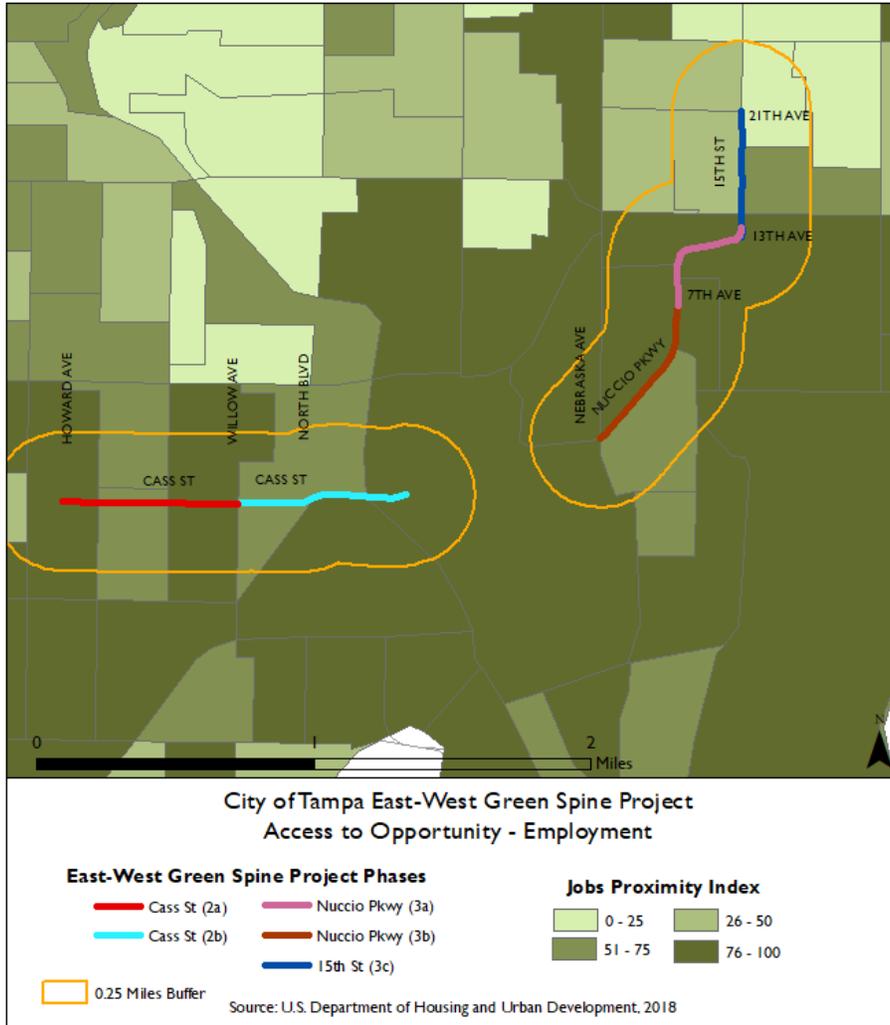


Figure B 16. East-West Green Spine jobs proximity index

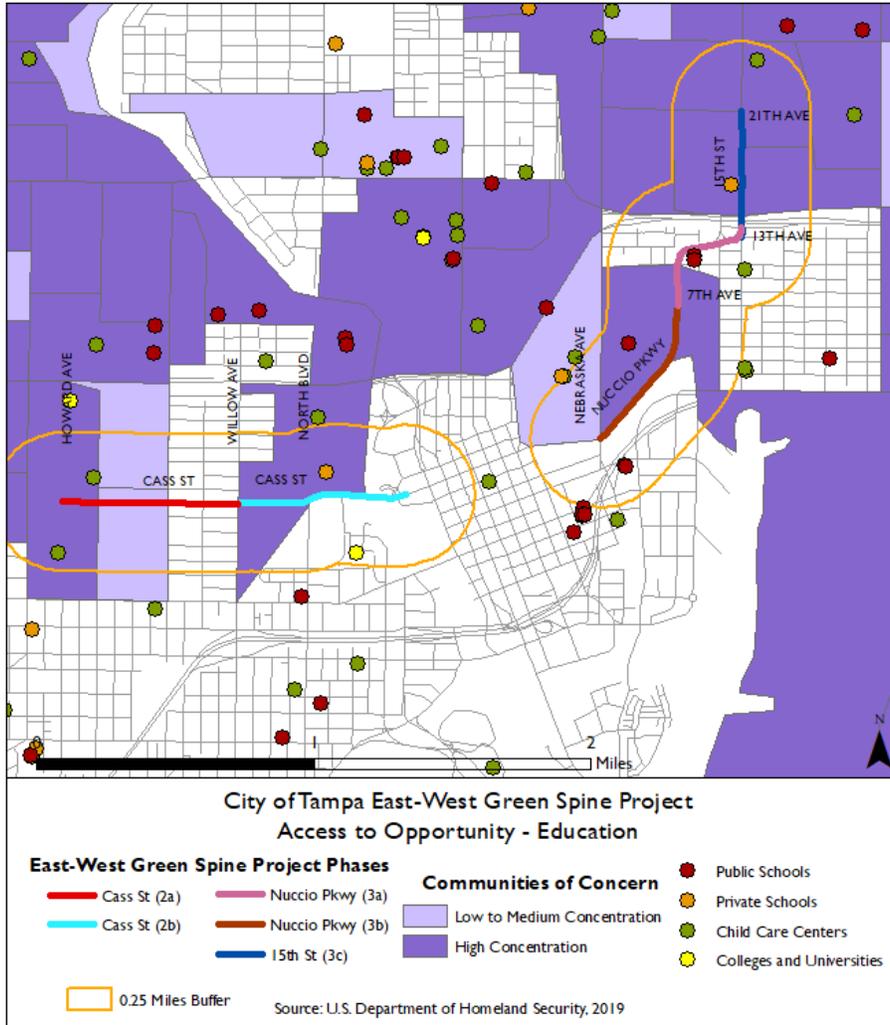


Figure B 17. East-West Green Spine project access to education

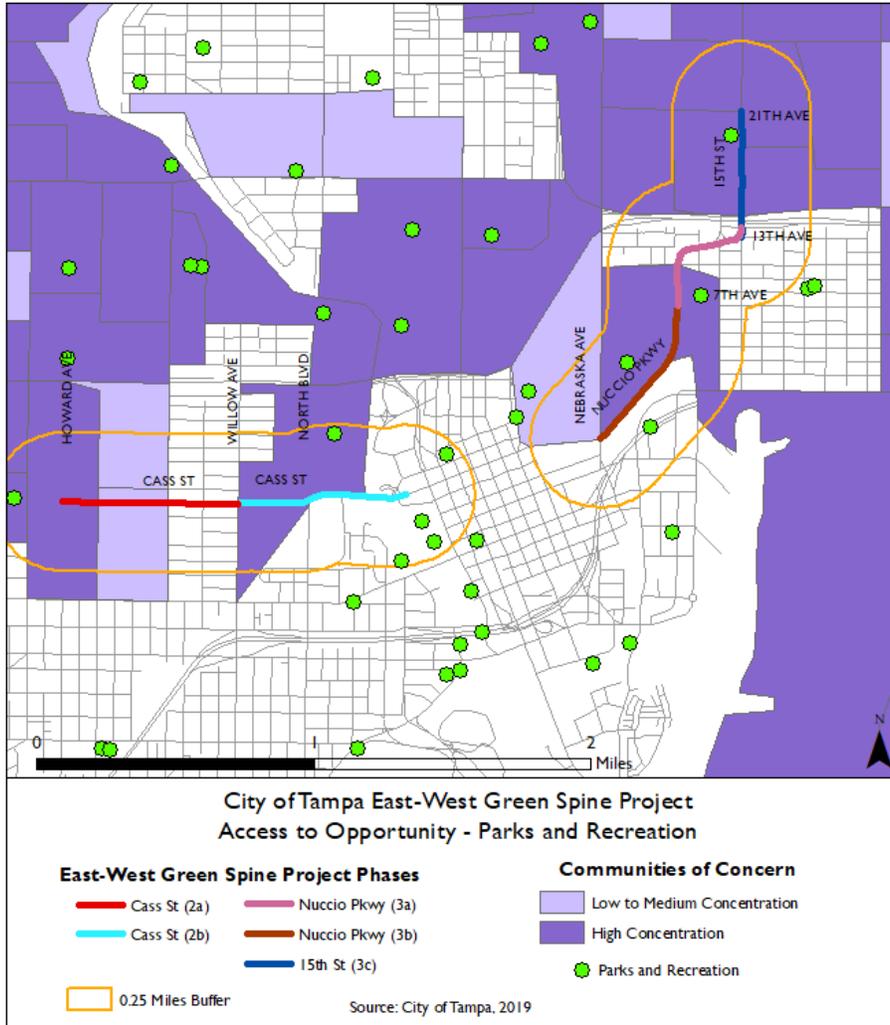


Figure B 18. East-west Green Spine project access to parks and recreation

Health and Environment

Health care and food layers are obtained from the data sources identified in Table B 2.

- The project improves access to health care for phase 2 only and it enhances access to food for both phase 2 and 3 as illustrated in Figure B 19 through Figure B 21.
 - GIS mapping shows several health care facilities near the project and a few health care facilities within a ¼-mile of the project for phase 2.
 - The project corridor overlays on low access food areas and is within a ¼-mile of a grocery store for phases 2 and 3.

The project description is also examined to identify details related to community cohesion, aesthetics, and noise reduction.

- The project proposes improved walking and biking by providing a safer environment for pedestrians and bicyclists. The improvements will improve the aesthetics of the area with landscaping and afford the potential for social interaction for both phases 2 and 3.

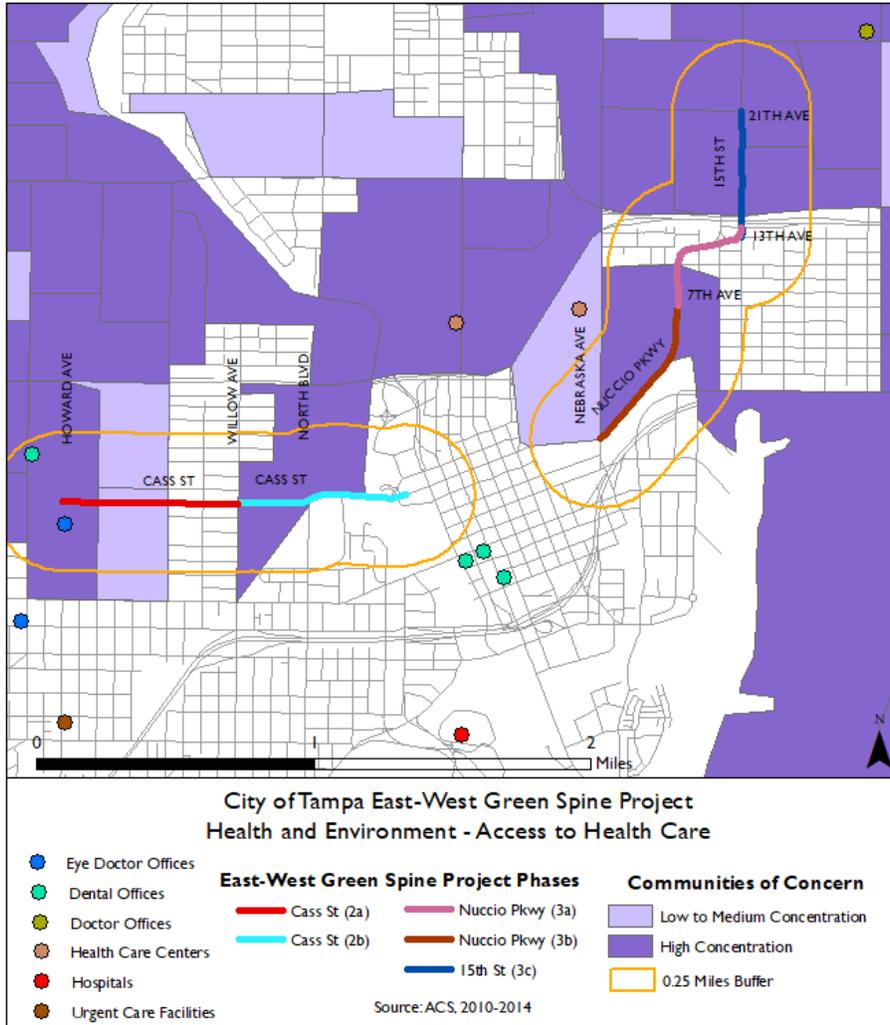


Figure B 19. East-West Green Spine project access to health care

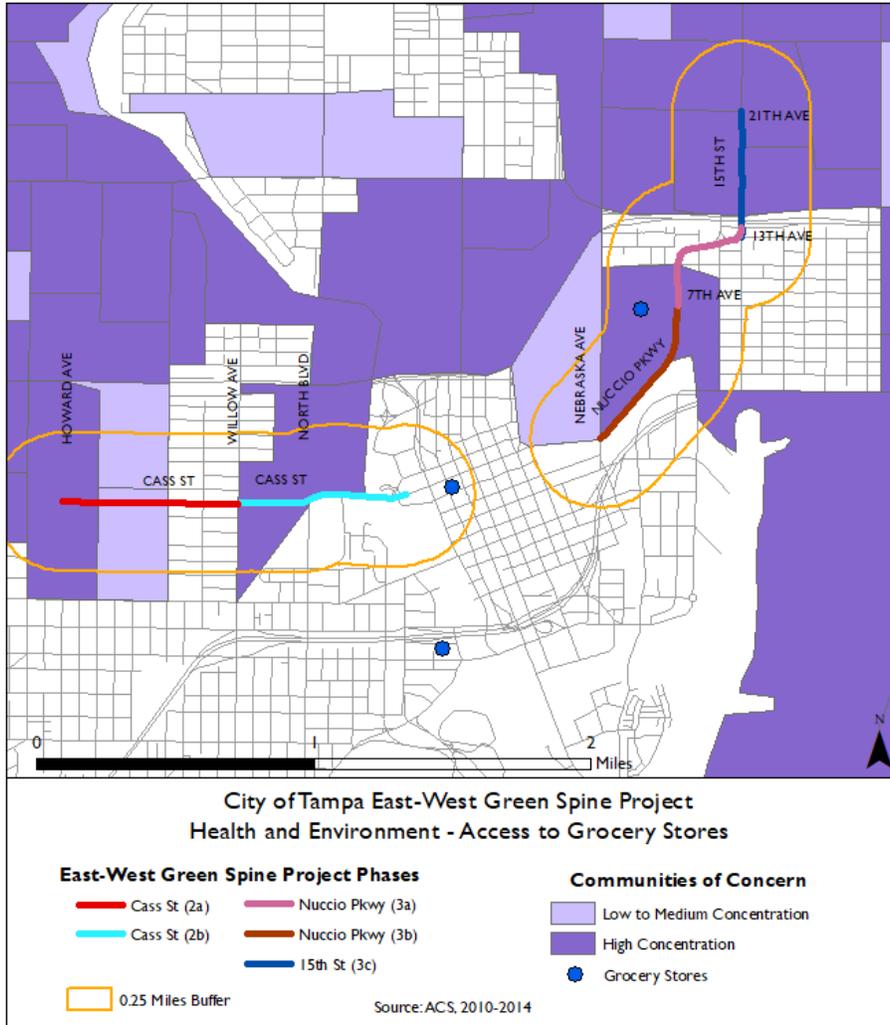


Figure B 20. East-West Green Spine project access to grocery stores

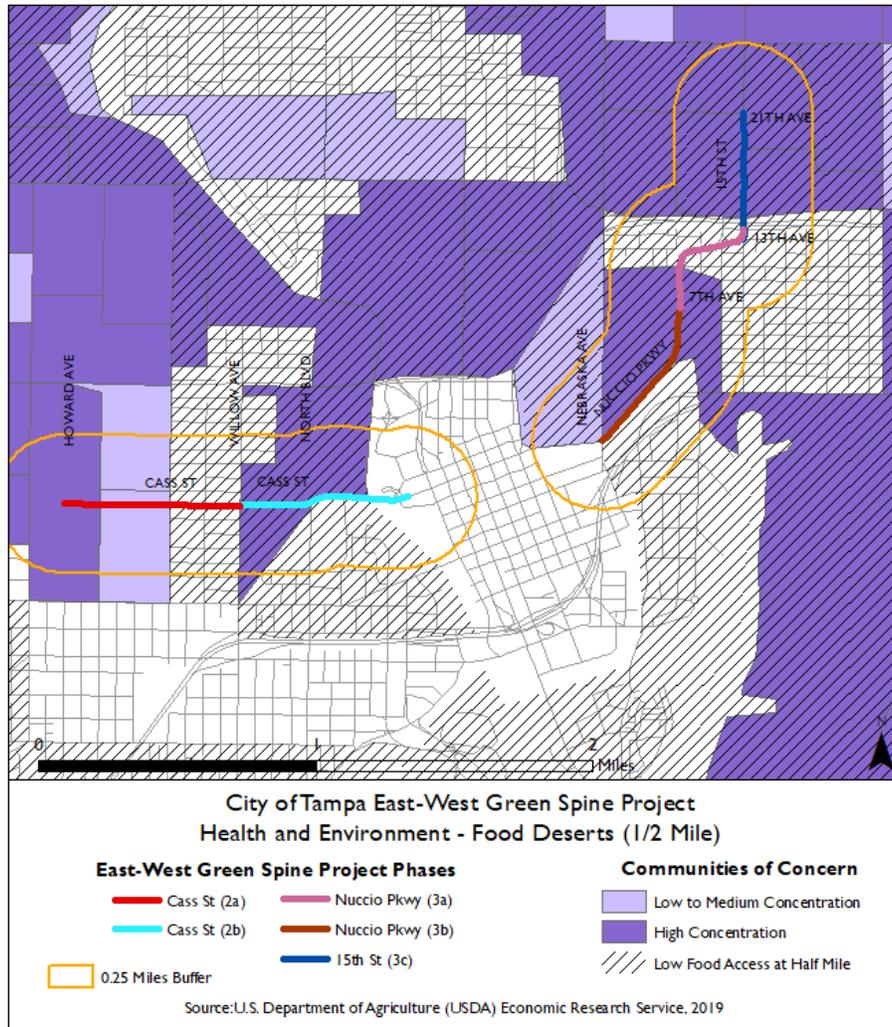


Figure B 21. East-West Green Spine project food deserts at half mile

Safety and Emergency Evacuation

Data from the Hillsborough MPO, used for a previous equity study conducted by Williams and Golub (2017), were used to identify and map locations with high pedestrian and bicycle crash rates. The project corridors and the ¼-mile project corridor buffers are overlaid on high crash layers to determine if the project covers high crash areas and non-high crash areas. The project description is then used to determine if any safety countermeasures have been proposed.

- The project includes safety countermeasures to reduce crashes at high crash locations and other (non-high crash) locations (see Figure B 22).

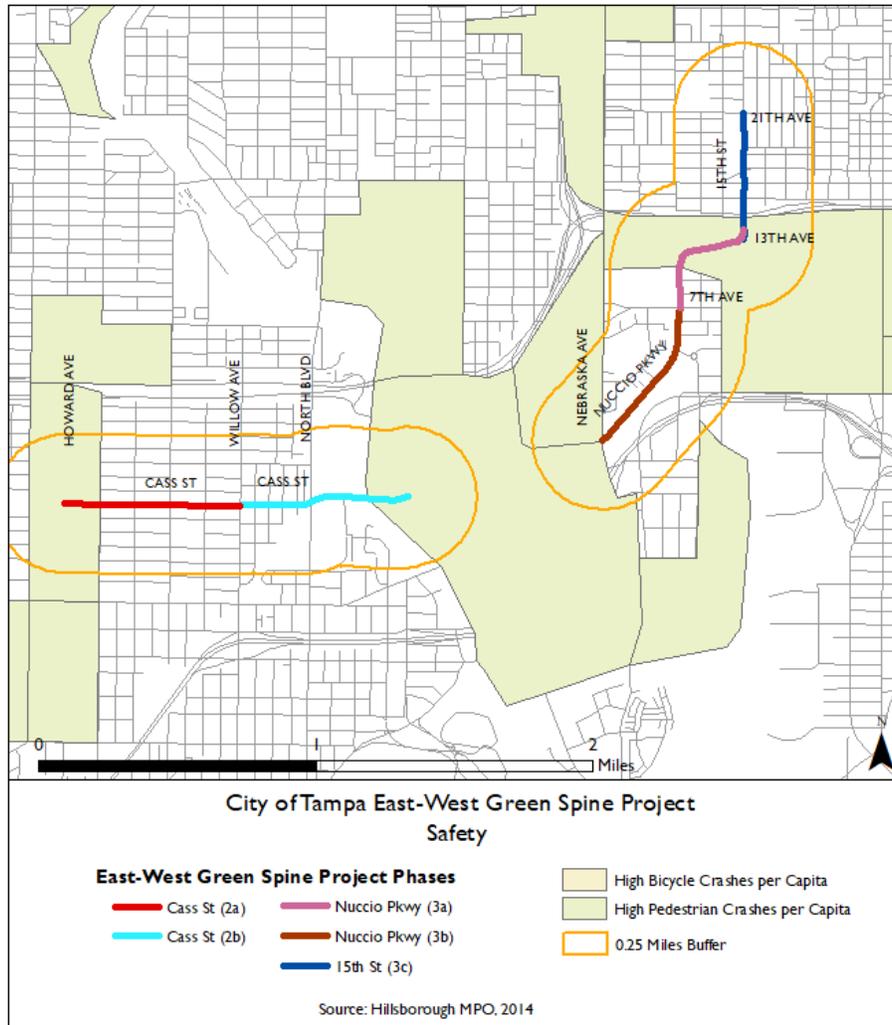


Figure B 22. East-West Green Spine project safety

The project is mapped and a ¼-mile buffer is created around it. Shelters and emergency medical services (EMS) (see Table B 3) are overlaid on the project to determine the availability of these facilities within a ¼-mile of the project.

- For both phases 2 and 3, the project improves emergency evacuation because it is in close proximity to at least one national shelter facility within a ¼-mile of the project, as shown in Figure B 23.

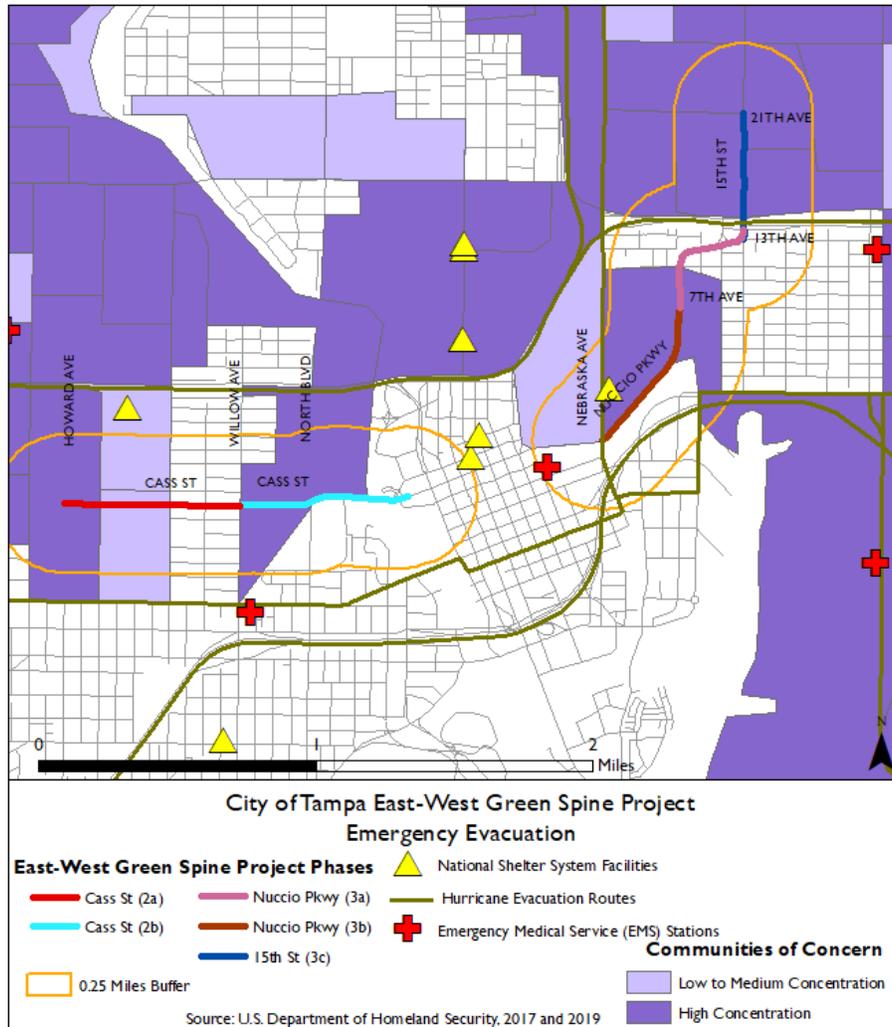


Figure B 23. East-West Green Spine project emergency evacuation

Affordability

The data in Table B 4 is used to evaluate affordability.

- The project improves access to affordable housing. There are multifamily properties receiving subsidies or grants from HUD and low income housing tax credit properties near the project. The project also serves areas where a high percentage of the population have housing choice vouchers (see Figure B 24 and Figure B 25).

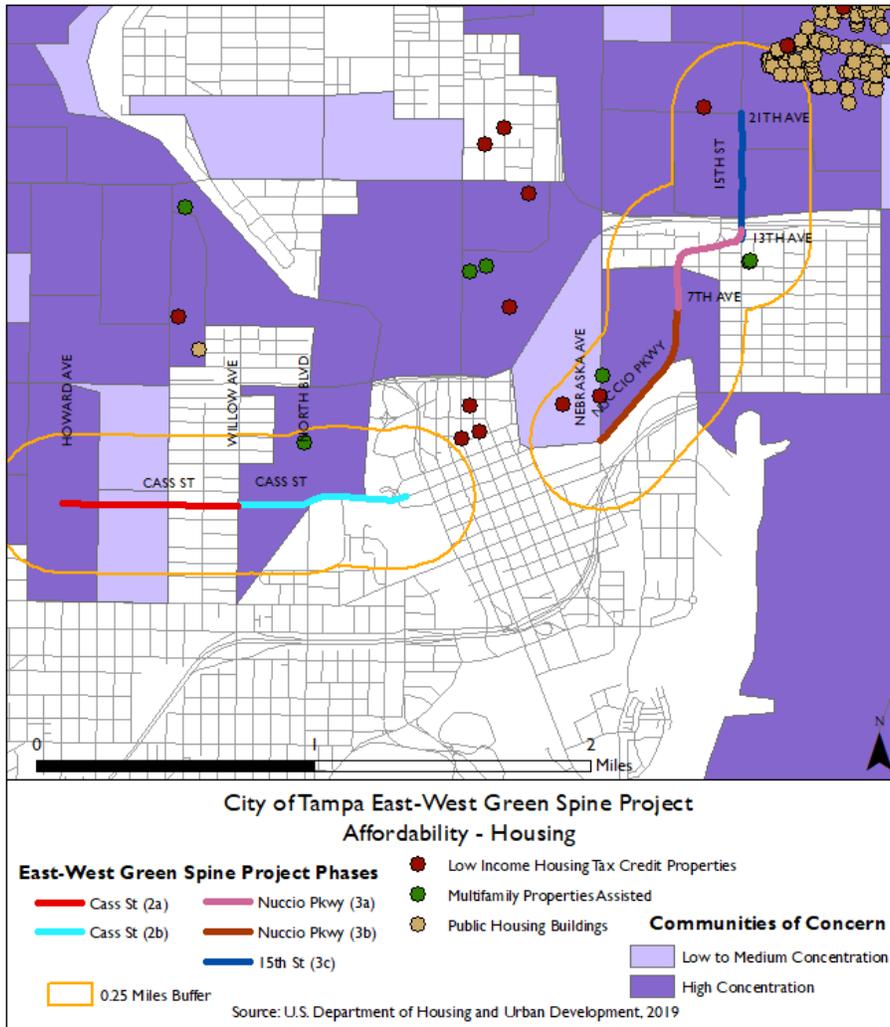


Figure B 24. East-West Green Spine project affordable housing access

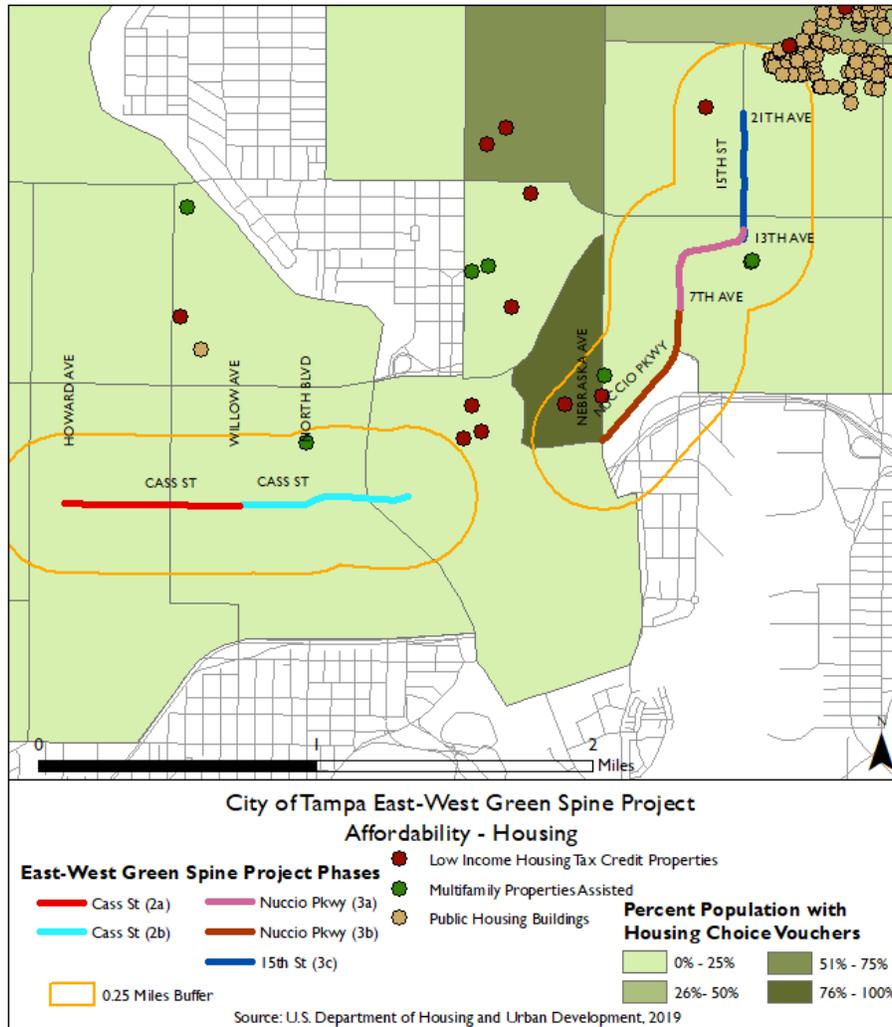


Figure B 25. East-West Green Spine project area housing choice vouchers

The project description is also reviewed to find details related to affordable transportation options. The map of the transportation cost index is generated using data from HUD to show areas with high transportation costs near the project. An assessment of how the project will help reduce transportation cost is conducted.

- Although transportation costs for communities near the project are not as high, the project improves affordable transportation choices with improved infrastructure for walking and biking (see Figure B 26).

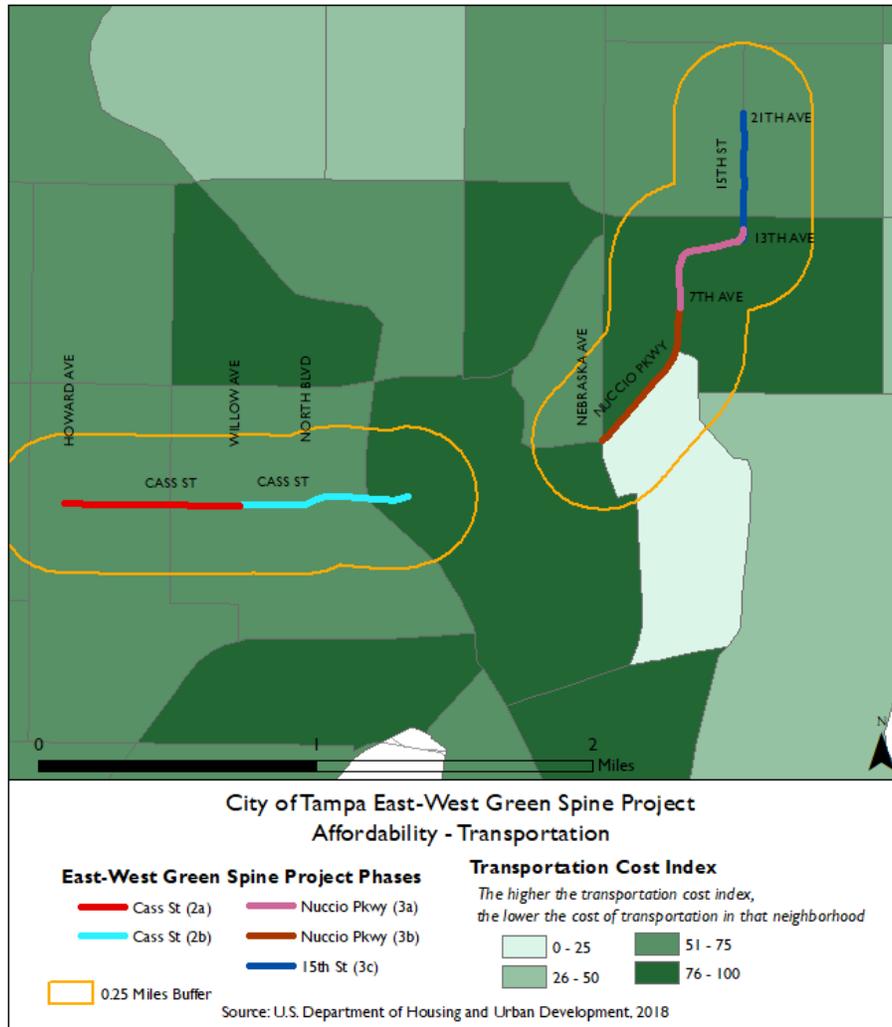


Figure B 26. East-West Green Spine project area transportation cost index

The project is overlaid on the map of housing and transportation costs percent of income using available national data from HUD (see Table B 4). A ¼-mile buffer is created around the project. Information from the project description, including the project type, are also considered for affordable transportation improvements or additions.

- For both phases 2 and 3, the project spans areas where housing and transportation costs are more than 50 percent of household income. The project will improve walking and biking in those areas, thus providing affordable transportation options in areas burdened by high transportation and housing costs (see Figure B 27).

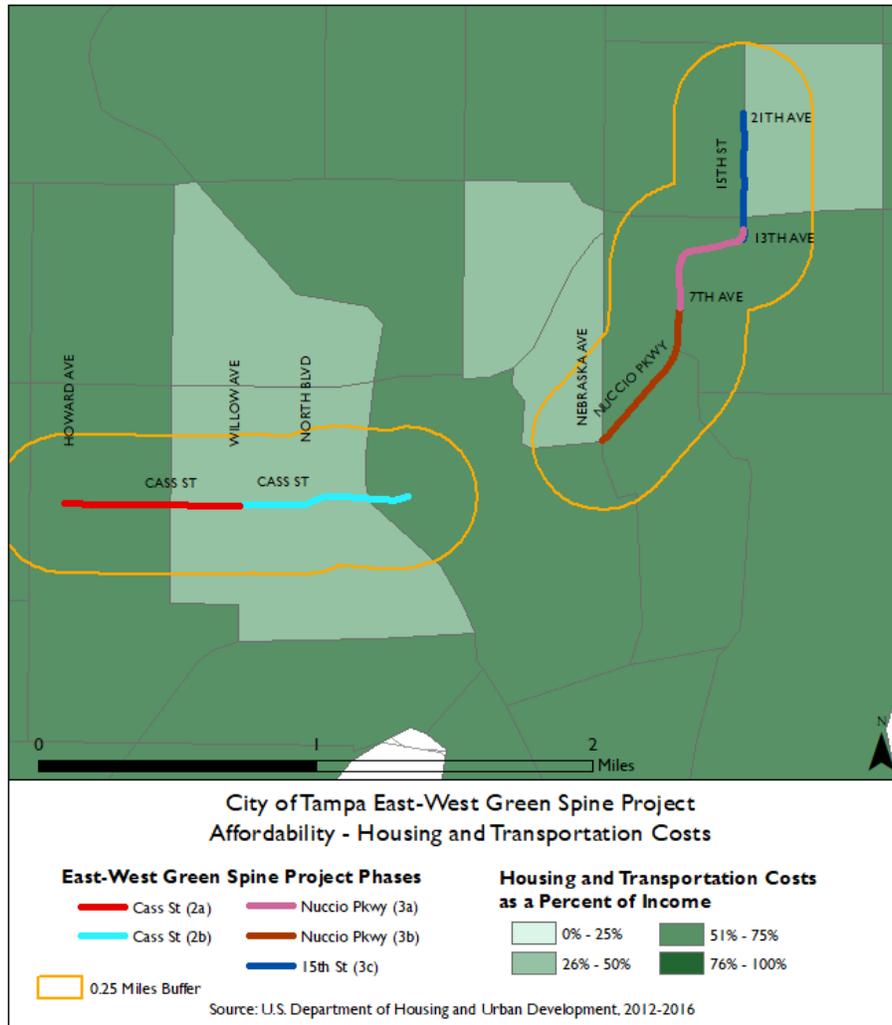


Figure B 27. East-West Green Spine project area housing and transportation cost burden

Mobility

The project details are used to determine if the project includes active transportation improvements or additions.

- The main objective of the project (phases 2 and 3) is to provide connections around the downtown area and the surrounding neighborhoods by constructing an urban cycle track with bike lanes and sidewalks.
- Transit routes and stops and the project are mapped using data from the Hillsborough MPO. A ¼-mile buffer is created around the project and is used to evaluate the availability of routes and stops near the project.
- The project corridor includes HART routes and stops, as shown in Figure B 28.
- Project details are reviewed to determine if special measures are included to improve accessibility for persons with disabilities, including correcting existing deficiencies.
- The project improves transit stop accessibility.

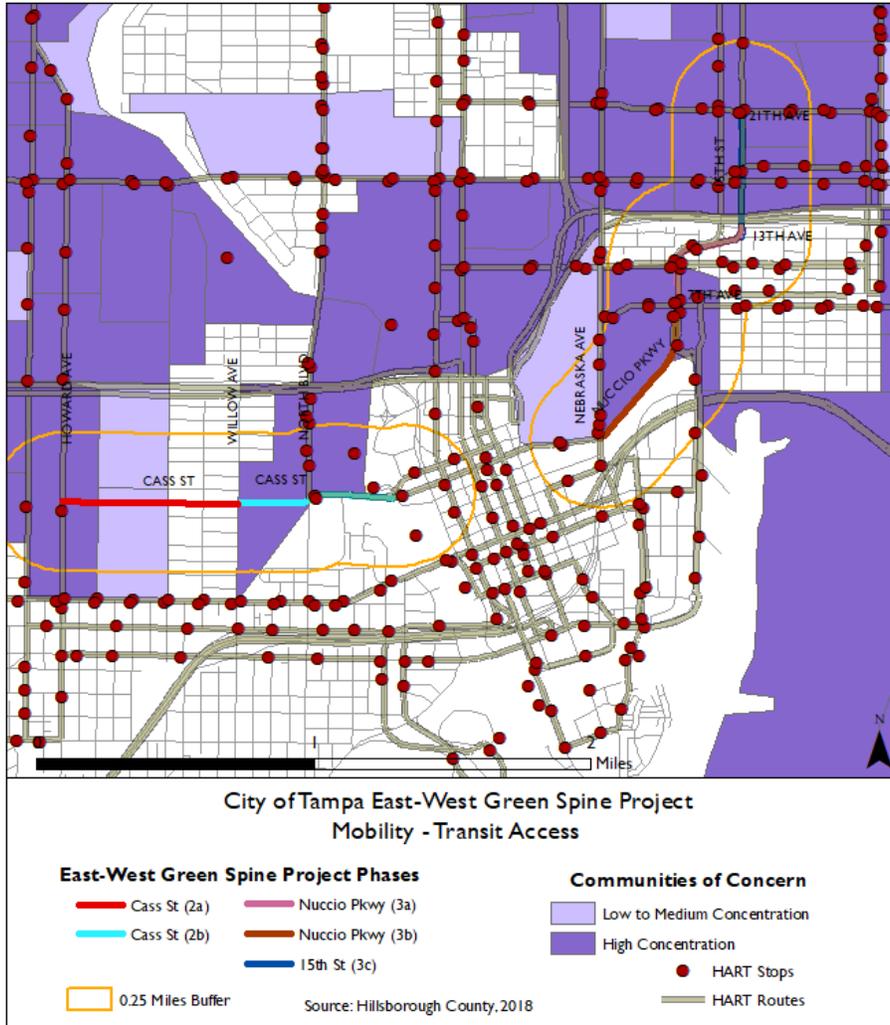


Figure B 28. East-West Green Spine project area transit access

Burdens

- Based on the project description and other available information, no burdens or negative impacts have been identified.

Results

Project ID	34th Street	East West Green Spine Phase 2	East West Green Spine Phase 3
Factor			
Employment	2	2	2
Education	4	4	4
Community Services and Shopping	4	4	4
Health Care	2	4	0
Healthy Food	4	4	4
Environment	2	4	4
Safety (High Crash Locations)	4	2	2
Safety (Non-High Crash Locations)	2	2	2
Emergency Evacuation	2	2	2
Housing	2	2	2
Transportation	2	2	4
Housing and Transportation Costs	2	2	2
Active Transportation	4	4	4
Transit Access and Service	2	2	2
Americans with Disabilities Act (ADA)	2	2	2
Adverse Impacts	0	0	0
Total Score	40	42	40

Figure B 29. Example scores

Project ID	Total Score	Project ID	Total Score	Project ID	Total Score
Project ID	Access to Opportunity	Project ID	Health and Environment	Project ID	Safety and Emergency Evacuation
34th Street	10	East West Green Spine Phase 2	12	34th Street	8
East West Green Spine Phase 2	10	34th Street	8	East West Green Spine Phase 2	6
East West Green Spine Phase 3	10	East West Green Spine Phase 3	8	East West Green Spine Phase 3	6

Project ID	Total Score	Project ID	Total Score	Project ID	Total Score
Project ID	Affordability	Project ID	Mobility	Project ID	Burdens
East West Green Spine Phase 3	8	34th Street	8	34th Street	0
34th Street	6	East West Green Spine Phase 2	8	East West Green Spine Phase 2	0
East West Green Spine Phase 2	6	East West Green Spine Phase 3	8	East West Green Spine Phase 3	0

Figure B 30. Example project ranking

Appendix C

Instructions to Modify the Automated Tool

C.1 Editing Questions

Use the following steps to modify questions in the evaluation forms:

1. Click the Developer tab in the menu. If the Developer tab is not visible, see instructions to add tabs to the ribbon in Section C.1.2
2. Click Design Mode and then click Visual Basic (see Figure C 1), a popup window will appear

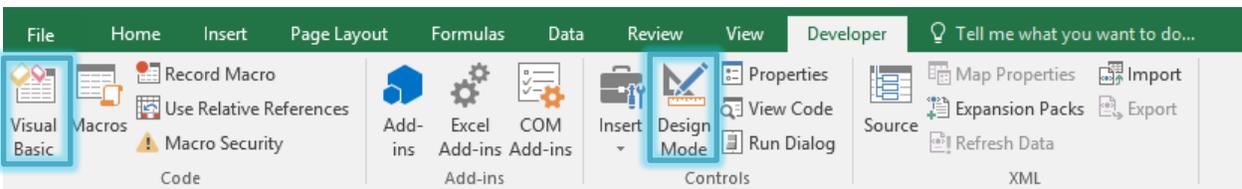


Figure C 1. Enter design mode and open Visual Basic

3. In the left panel, locate the Forms menu. Click the plus sign (+) next to Forms to expand the menu options (see Figure C 2)
4. Double click UF1 to open the primary form associated with adding projects

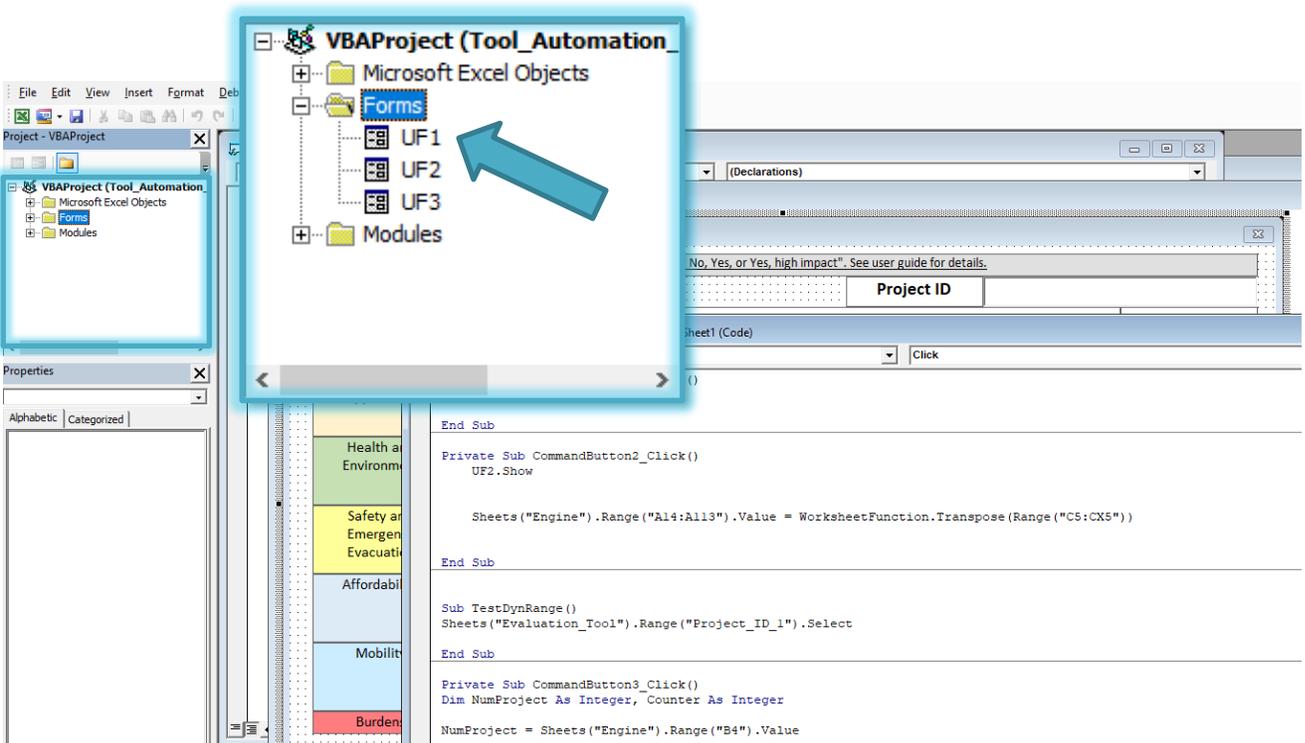


Figure C 2. Visual Basic

5. Click on the criterion question you want to modify, a table of properties will open in the left panel. If the table of properties does not open, right click on the criterion question you want to modify and select properties
6. In the table of properties, locate the Caption cell. Click on the cell to the right to edit the criterion question (see Figure C 3)

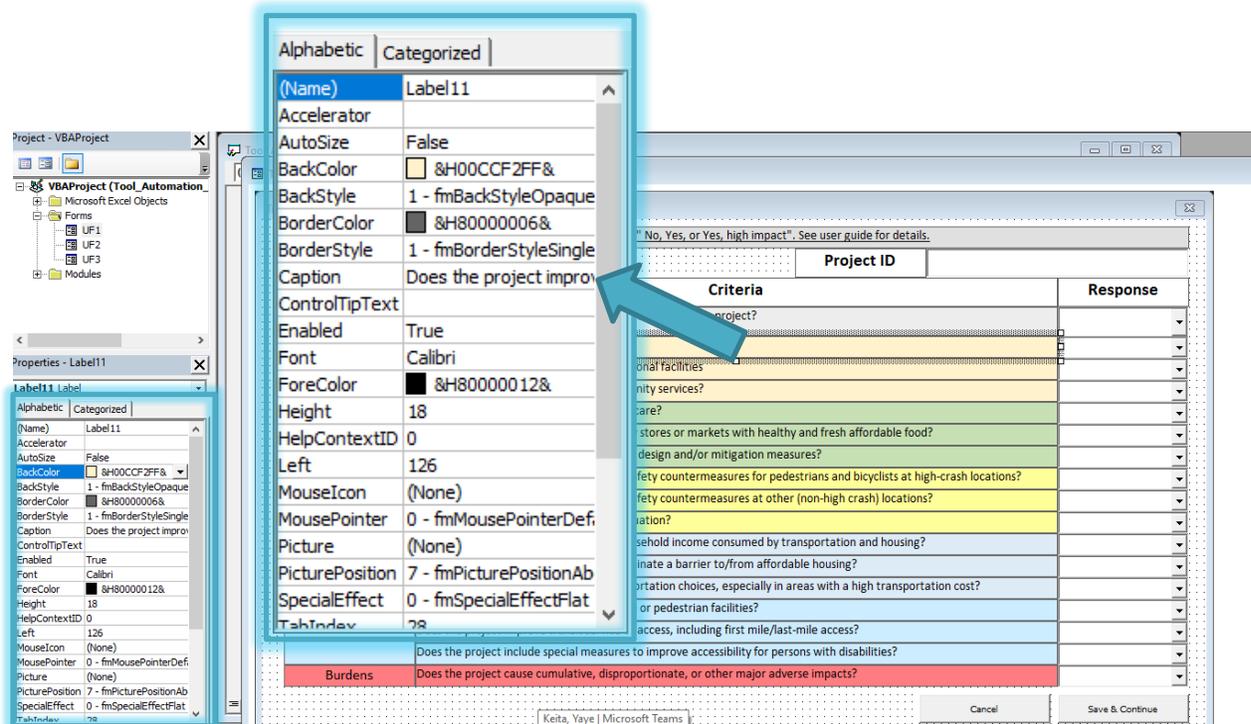


Figure C 3. Edit criteria

7. Repeat steps 5 and 6 as needed to modify criteria questions
8. In the left panel, double click UF3 to open the primary form associated with editing projects
9. Repeat steps 5 through 7 to edit the criteria questions. Ensure that the criteria questions in UF1 and UF3 are the same.
10. Exit Visual Basic
11. Click Design Mode and review the changes
12. Save the edited tool

C.1.2 Adding the Developer Tab

Use the following steps to add the Developer tab to Excel:

1. Click on the File tab
2. Click Options, a pop-up window will appear (see Figure C 4)



Figure C 4. Open the Excel options window

3. Click Customize Ribbon
4. Click the checkbox next to Developer to add the tab to the ribbon (see Figure C 5)

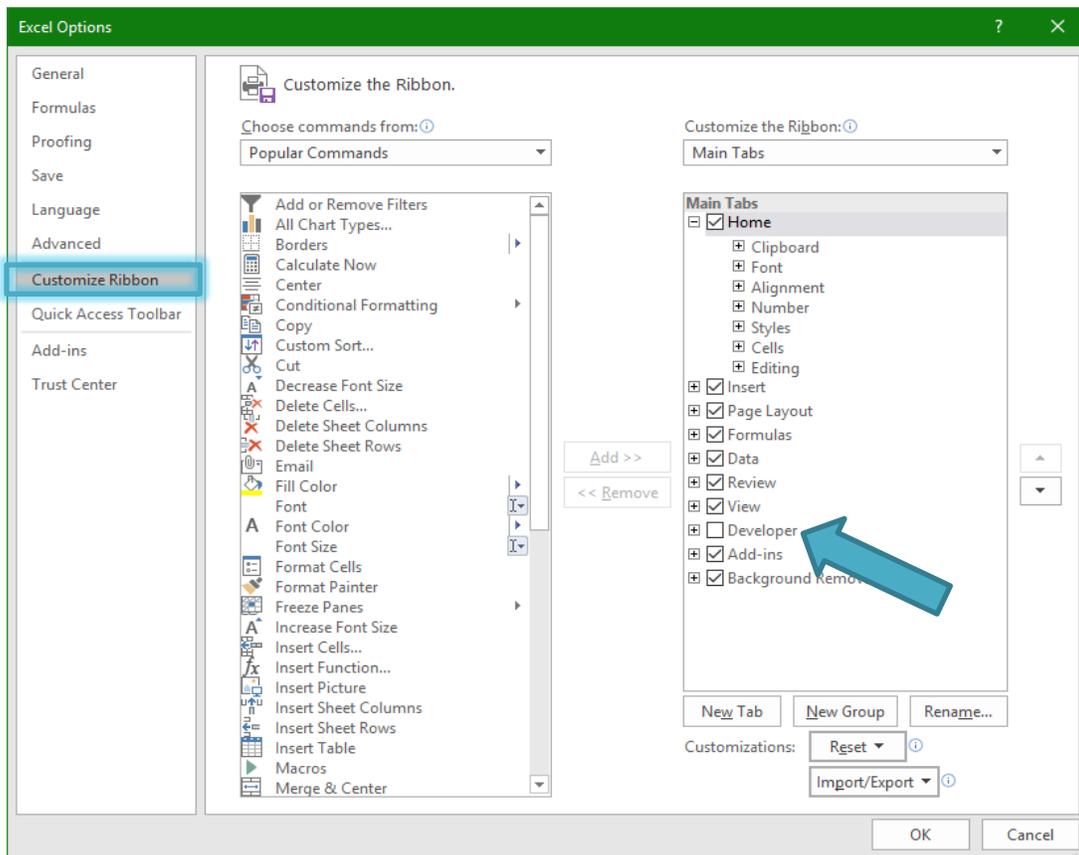


Figure C 5. Add developer tab

5. Click OK, the popup window will close. The Developer tab should now be visible in the menu

